1. The year 2023 has been designated as the International Year of Millets. The Indian government has also pushed for millets to be cultivated. Why? What are its benefits? Discuss.

Approach

Candidates can start the answer with highlighting governments efforts for promoting millets. Then simply write why its important to encourage millets and benefits in later part.

Introduction

India's proposal to observe an International Year of Millets in 2023 was approved by the Food and Agriculture Organisation (FAO) in 2018 and the United Nations General Assembly has declared the year 2023 as the International Year of Millets.

Body

About:

- Millet is a collective term referring to a number of small-seeded annual grasses that are cultivated as grain crops, primarily on marginal lands in dry areas in temperate, subtropical and tropical regions.
- Some of the common millets available in India are Ragi (Finger millet), Jowar (Sorghum), Sama (Little millet), Bajra (Pearl millet), and Variga (Proso millet).

Why millets are important:

- According to the Ministry of Agriculture & Farmers Welfare, in 2016 – 2017, the area under the cultivation of millet declined with 60% less coverage area (to 14.72 million hectares) due to change in consumption pattern, conversion of irrigated area for wheat and rice cultivation, unavailability of millets, low yield, dietary habits, less demand.
- This resulted in fall in the level of nutrients like vitamin-A, protein, iron and iodine in women and children leading to malnutrition.

Benefits of millets:

Nutritional Security:

- Millets are less expensive and nutritionally superior to wheat & rice owing to their high protein, fibre, vitamins and minerals like iron content.
- Millets are also rich in calcium and magnesium.
- Although Millets are rich in phytochemicals like tannins, phytosterols, polyphenols and antioxidants, they do contain some anti-nutritional factors which can be reduced by certain processing treatments.
- For example, Ragi is known to have the highest calcium content among all the food grains.
- Its high iron content can fight high prevalence of anaemia in Indian women of reproductive age and infants.

Climate Resilient:

- They are also harder and drought-resistant crops, which has to do with their short growing season (70-100 days, as against 120-150 days for paddy/wheat) and lower water requirement (350-500 mm versus 600-1,200 mm).

Economic Security:

- As low investment is needed for production of millets; these can prove to be a sustainable income source for farmers.

Can Tackle Health Issues:

- Millets can help tackle lifestyle problems and health challenges such as obesity, lowers the risk of hypertension, CVDs, T2DM, cancers and diabetes as they are gluten-free and have a low glycaemic index (a relative ranking of carbohydrates in foods according to how they affect blood glucose levels).

Conclusion

Accessibility to the poor, millets can play an essential role in providing nourishment to people across all income categories and supporting climate adaptation of rainfed farming systems. There's a need for developing a decentralized model of processing capabilities so that the growers stand to benefit at a community level and in the growing regions.

2. What are the some of the most sustainable irrigation methods ?what are the challenges to their wide scale adoption in India ? discuss .

Approach-

A simple straightforward question where candidates need to write about what are most sustainable irrigation methods prevalent in India and in second part write about what are challenges in their wide scale adoption in India.

Introduction

Sustainable irrigation refers to any activity or practice relating to irrigation such that it helps to satisfy the welfare and survival needs of the present without compromising the needs of future generations. It could be irrigation of agricultural areas, or landscapes.

Body

The amount of water utilized in irrigation varies significantly depending on several factors such as climatic conditions, type of crops grown, and the irrigation system used. In flood and furrow system much water is lost through percolation and evaporation.

- To curb excess water loss, we must employ more efficient systems such as drip, sprinkler, and micro spray types of irrigation.

Sprinkler Irrigation-

- In this type of irrigation, water is sprayed or sprinkled into the field. Pressurized water is channeled to the system via underground pipes.
- Sprinkler irrigation systems control water more efficiently hence regarded as an ideal than surface irrigation.

Drip irrigation-

- It is a system of irrigation that distributes water on crops at a low rate and pressure on calculated positions so that the water reaches the target shoot. From pipes, the water drips from small holes (emitters) to wet a desired part on the ground. Micro-irrigation is ideal for tree irrigation, shrubs, and vineyards.
- Drip irrigation is the most effective practice with water use efficiency of around 85-90 per cent.
- Another advantage is maintenance of optimum soil moisture conditions that help increase overall productivity and profitability. Across various studies, it has been found that the adoption of micro-irrigation systems helped boost the yield of fruit as well as vegetable crops.
- Another gain has been the adaptation of diverse cropping patterns.
- It is quite evident that importance of micro-irrigation to achieve sustainability in Indian agriculture cannot be neglected. But it's a long way ahead and requires extensive demonstrations, training and awareness programmes to bring Indian farming community abreast with micro-irrigation practices.
- To curb excess water loss, we must employ more efficient systems such as drip, sprinkler, and micro spray types of irrigation. Though expensive and tech-demanding, these systems use the least water resources adequately.

Challenges to wide scale adoption in India -

- Adoption of micro-irrigation has been slow among farmers in India in spite of concerted efforts.
- First, subsidies alone will not lead to greater adoption since decisions on adoption are shaped by household, farm level and institutional factors. Secondly, mere adoption of micro-irrigation will not result in water conservation because farmers are seen to expand the area under irrigation or shift to water-intensive crops.
- Irresponsibility by State Governments: In most Indian states (with Gujarat and Tamil Nadu being the major exceptions), the scheme is operational only for a few months in a year.
- Despite the availability of funds, scheme applications are processed only at the end of a financial year, done typically to achieve pre-set targets in what is famously known as the 'March rush'.
- As a result of this narrow window, only a handful of farmers can apply.
- Delays in the Reimbursement of Subsidies: Unlike other subsidies that are directly transferred to beneficiaries, those for installing drip irrigation systems are transferred to vendors only after due diligence.
- There is no fixed timeline for the inspection and testing of the installed system for transferring subsidies.
- Financial Difficulties: The farmers often face difficulty in getting necessary support from financial services.

- Availability of Power: The main input for an irrigation system is energy, and for large scale projects, only electricity is a viable source which, despite having respective welfare schemes in place, is still beyond the reach of every farmer.

Way Forward-

- Role of Administration: Setting a timeline for each stage, from an application by a farmer to the execution and payment disbursement and strengthening the government's monitoring mechanism by insisting on a periodic review of applications, approvals, work orders and actual installations.
- Deploying direct benefit transfers for subsidy sums for micro-irrigation to go straight into the bank accounts of farmers.
- Also, farmers should be made able to avail the benefits of such welfare schemes in accordance with their crop cycles or sowing patterns.
- Expanding the Scope of Micro-Irrigation: The capital cost required for the drip-irrigation method should be brought down substantially.

Conclusion-

The future revolution in agriculture will come from precision farming. Micro-irrigation can, indeed, be the stepping stone for achieving the goal of making farming sustainable, profitable and productive.

3. With the help of suitable examples, discuss the role of GIS technology in improving farm productivity.

Approach -

In this question candidates need to write about role of GIS technology in improving farm productivity and give some examples of it.

Introduction-

GIS in agriculture has been boosted by the general advancement of technology in the past few decades.It puts field data to work to maximize yields, reduce expenses, and mitigate damage from natural disasters..

Body -

The use of GIS in agriculture is all about analyzing the land, visualizing field data on a map, and putting those data to work. Powered by GIS, precision farming enables informed decisions and actions through which farmers get the most out of each acre without damaging the environment.

Government Policies:

- Information technology can enable eGovernance for agriculture, making range of services available to farmers and various stakeholders of the sector. Say for example a web portal at district level for providing eServices to the farmers, a monitoring and tracking application for fund utilizations

- Speaking of tools, geospatial technology in agriculture relies on satellites, aircraft, drones, and sensors.
- These tools are used to make images and connect them with maps and non-visualized data. As a result, you get a map featuring crop position and health status, topography, soil type, fertilization, and similar information.

Crop yield prediction-

- Accurate yield prediction can help governments ensure food security and businesses forecast profits and plan budgets.
- The recent development of technology connecting satellites, sensing, big data, and AI can enable those predictions

Crop health monitoring-

- Checking crop health across multiple acres manually is the least efficient option. This is where remote sensing combined with GIS in farming comes to the rescue.
- Satellite images and input information can be paired to assess environmental conditions across the field, such as humidity, air temperature, surface conditions, and others. Based on GIS, precision farming can upgrade such an assessment and help you decide which crops require more attention.

Livestock monitoring-

- The simplest application of farm GIS software in animal husbandry is the tracking of movement of specific animals.
- This helps farmers find them on a farm and monitor their health, fertility, and nutrition. GIS services that allow you to do that comprise trackers installed on animals and a mobile device that receives and visualizes information from those trackers.
- We could reduce undesirable encounters by understanding those subtle specifics, which could be done by the combined use of AI and GIS in agriculture.

Insect and pest control-

- The invasion of harmful insects and pests, or infestation, does heavy damage to agriculture. A look from above can enable accurate, timely alarms to prevent that.
- Yet even high-resolution images might not provide visible early signs of infestation.

Irrigation control-

- Keeping an eye on vast fields to make sure that each crop gets enough water is a challenging task, but one easily tackled by geoinformatics in agriculture.
- Aircraft and satellites equipped with high-resolution cameras take images that allow AI algorithms to calculate the water stress in each crop and spot visual patterns behind water shortages.

Flooding, erosion, and drought control-

- Marrying GIS and agriculture can help prevent, assess, and mitigate the negative impact of destructive natural phenomena.
- To identify flood-susceptible areas, you can use flood inventory mapping techniques.
- Need to collect data such as past floods, field surveys, and satellite images. Use those data to create a dataset to train a neural network to spot and map flood risks, and you will create an ultimate disaster management tool.

Farming automation-

- Seeding machines, intelligent irrigation systems, driverless harvesters, and weed remover robots are the inevitable future.
- GIS in farming can provide precise maps, including all necessary information about the crops in the field. Maps like those are called task maps or application maps. Smart machines use them to tend to the field.

Market Forces-

- Information Technology and GIS both can be used to address this challenge by promoting the public-private partnership in agriculture sector though eGovernance. Government can leverage the value of policies through G2B (Government to Business) and B2C (Business to Citizen/Farmers/Stakeholders
- example there can be a service on the eGov Portal for business to find right customers for their products & services for farming such as Seeds, Fertilizers; this can be facilitated by GIS in the backend. By using B2C services through the eGov portals businesses can run eCampaigns for the products.

Skills and Labour-

- eGovernance at grass root level can be used to run agricultural skills development and creating the pool of labour for particular farming needs. eGovernance can be powered by Information Technology and GIS. Public Private Partnership can be used to make the training programmes available to farmers and stakeholders. Provisioning of labour can be regulated by using eGovernance outlets.

Conclusion -

A Geographic Information System (GIS) is a tool used to collect, store, distribute, analyse, and display information about a given geographic area. Agriculture has found this system to be useful in a variety of ways including boost the output of farmers and also cut costs and better manage their property as a result of these developments.