Date –7 September 2022

Liquid nano urea

News: Nano urea fast-tracked for approval despite incomplete trials.
GS Paper 3: Technology Missions; Science and Technology- Developments and their Applications and Effects in Everyday Life; Awareness in the fields of Nano-technology.

What is liquid nano urea?

- Nano Urea contains nitrogen, an element critical for plant development, in the form of granules that are a hundred thousand times finer than a sheet of paper. It is urea in the form of a nanoparticle.
- Urea is a chemical nitrogen fertilizer, white in colour, which artificially provides nitrogen, a major nutrient required by plants.
- The product has been developed at IFFCO's Nano Biotechnology Research Centre (NBRC) at Kalol.

How does liquid nano urea work?

- Liquid nano urea is sprayed directly on the leaves and gets absorbed by the plant. Fertilizers in nano form provide a targeted supply of nutrients

to crops, as they are absorbed by the stomata, pores found on the epidermis of leaves.

- Unlike the coarse particles that farmers normally throw onto the soil during sowing, the nano particle in form of Nano Urea, when applied on to the leaves, stimulates a range of enzymes, like nitrase and nitrite reductase, which helps plants metabolise nitrogen.
- Liquid nano urea process uses "organic polymers" that keeps the 'nano' particles of nitrogen stable and in a form that can be sprayed onto plants.
- Liquid nano urea contains 4 per cent total nitrogen (w/v) evenly dispersed in water. The size of a nano nitrogen particle varies from 20-50 nm.
- IFFCO, maker of liquid nano urea, advises that 2-4 ml of nano urea should be mixed a litre of water and sprayed on crop leaves at active growth stages.

What are the advantages of liquid nano urea over conventional urea?

- It will help in reducing the country's subsidy bill in reducing unbalanced and indiscriminate use of conventional urea, increase crop productivity, and reduce soil, water, and air pollution.
- **High efficiency of liquid nano urea:** Efficiency of liquid nano urea is as high as 85-90 per cent while conventional urea has an efficiency of about 25 per cent. Currently, 70% of the urea applied today is wasted and remaining 30% actually makes it to the plant depends on a multitude of factors from how you spray to the soil quality
- **Despite indiscriminate use of conventional urea** , conventional urea fails to have the desired impact on crops as it is often applied incorrectly, and the nitrogen in it is vaporised or lost as gas. A lot of nitrogen is also washed away during irrigation.
- **High shelf life of liquid nano urea:** Liquid nano urea has a shelf life of a year, and farmers need not be worried about "caking" when it comes in contact with moisture.

In what respects is the indigenous liquid nano urea a better bet than imported urea?

- India is dependent on imports of the widely used fertiliser hence paying high fertiliser subsidy. The government's fertliser subsidy payout this financial year will be Rs 2 lakh crore, up 25 per cent from the Rs 1.6 lakh crore it paid last year.

- Currently the liquid nano urea produced by Indian Farmers Fertiliser Cooperative (IFFCO) Limited comes in a half-litre bottle priced at Rs 240, and carries no burden of subsidy. By contrast, a farmer pays around Rs 300 for a 50-kg bag of heavily subsidised urea.
- The international market price of a bag of urea is between Rs 3,500 and Rs 4,000, and significant quantities of it are imported. But, a bottle of the nano urea can effectively replace at least one bag of urea.

Issues associated with application of liquid nano urea:

- Scientists are puzzled that how nano urea sold in 500 ml bottles has only 4% nitrogen (or around 20 gm) will compensate for chemically packaged urea that is 46% nitrogen, which means a 45 kg sack contains about 20 kg of nitrogen.
- It is unclear as to how nanoparticles can increase the effectiveness of nitrogen uptake by being still smaller as urea is highly water soluble and already reaches the lowest form of concentration when absorbed.
- Effectiveness of foliar spraying (spraying on leaves) in improving fertilizer uptake is unknown.
- Data that shows the increase in yields due to Nano Urea was superfluous as it was simply explained by the fact that in the first year, the nitrogen present in the soil and fertilizer was sufficient, due to which supplying nitrogen via Nano Urea will not change anything on ground.
- Difficulty in weaning farmers away from packaged urea overnight as these are deeply ingrained behaviors.

Sharad

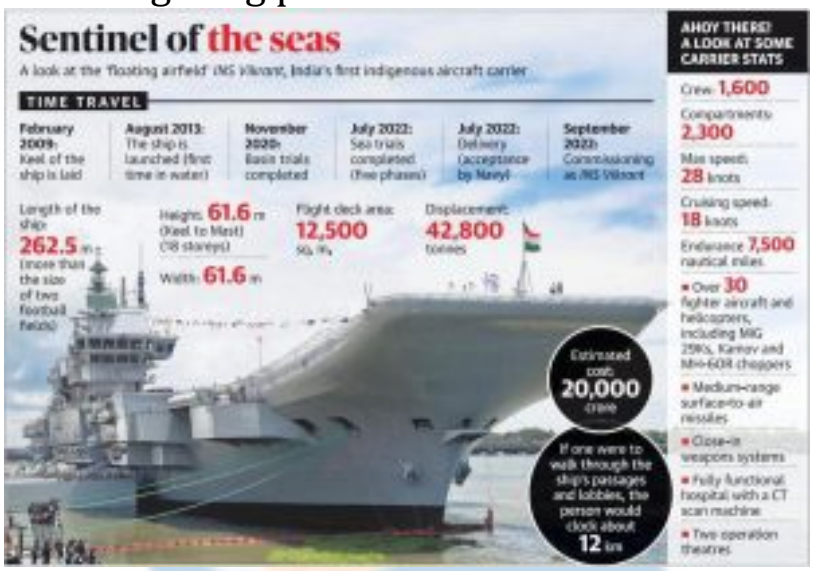
INS Vikrant and Maritime Strategy

GS Paper 3: Security Challenges and their Management in Border Areas – Linkages of Organized Crime with Terrorism.

About INS Vikrant:

- INS Vikrant is India's largest and most complex indigenously built warship
- It is developed by the Navy's warship design bureau and constructed by the Cochin Shipyard Limited (CSL).

- With a displacement of 43,000 tonnes, the ship boasts an endurance of about 7,500 nautical miles and a cruising speed of 18 knots (significant for its size and tonnage).
- The ship's integral fleet of MiG 29K aircraft, Kamov 31 early warning and MH-60R multi-role helicopters, as also state-of-the-art shipboard offence and defence systems, surveillance and fire-control radars, make it a formidable warfighting platform.



Why is INS Vikrant key to India's maritime strategy?

- An aircraft carrier is an instrument of utilitarian value as well as beating heart that provides all naval effort with its essential vigor.
- Aircraft carriers like INS Vikrant provide thorough and emphatic access to littoral spaces in war as well as in peace.
- **An aircraft carrier has the critical ability to alter the psychological balance in the littorals**. As, it will ensure effective sea command, through continuous and visible maritime presence that influences the cost-benefit calculus of the enemy commanders.
- It helps in **"power projection"** that is a crucial component of peacetime maritime strategy, and an embodiment of a nation's strategic capability and political intent. A navy's ability to project military power far beyond the home country is a metric of national influence and regional relevance.
- **Utility in advancing national objectives:** Demonstrative impact of an aircraft carrier sailing through foreign waters that cannot be replicated by a submarine or a destroyer.

- It will help in **enhancing Soft power diplomacy** through soft-power outreach such as hospital ships, humanitarian assistance and disaster relief platforms, survey vessels, etc and peacetime diplomacy.
- INS Vikrant will help in enhancing Indian strategic capacity in the Indian Ocean region as it will deter adversaries and mark its presence in the near-seas.
- It will **check "far-seas" strategy** and ambition of the People's Liberation Army Navy (PLAN) and the role that China's aircraft carriers are likely to play in the Pacific and the Indian Oceans.

What are various skepticism about the relevance of aircraft carriers in the contemporary world?

- **Low Cost-Benefit ratio:** Building aircraft carriers requires enormous cost and there is little point in spending billions for a carrier strike force to protect the Bay of Bengal or the Arabian Sea, when near-seas defence can be easily ensured from airbases on India's island territories.
- **Susceptible to enemy attack:** Aircraft carriers are considered as logistically unviable, and highly vulnerable to new hypersonic weapons and disruptive technologies.
- **Chances of aircraft carriers virtually sitting duck in a conflict scenario:** As they are defenceless against modern-day underwater attacks, long-range strategic airpower and ballistic missiles; a virtual sitting duck in a conflict scenario.
- **Symbolic value of Aircraft operating warships** make them prized targets in wartime.
- **Vulnerability of aircraft carriers:** Generally such ships are targets of heavy ordance as for navies locked in combat, the destruction of the opponent's aircraft carrier is a priority mission.

Conclusion: Deployment of maritime power needs to be anchored in the logic of geopolitics and long-term state interests, and not on contingent assessments of imminent needs.

Sharad

Cloudbursts

News: Over 20 people have been killed in destruction caused by cloudbursts and flash floods in different parts of Himachal Pradesh and Uttarakhand over the last three days.

GS Paper 1: Important Geophysical Phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.

GS Paper 3: Disaster and Disaster Management.

What are cloudbursts?

- A cloudburst is a localised but intense rainfall activity. Short spells of very heavy rainfall over a small geographical area can cause widespread destruction, especially in hilly regions where this phenomenon is the most common.
- During a cloudburst event, a place receives about 10% of this annual rainfall within an hour.
- Not all instances of very heavy rainfall, however, are cloudbursts.

Which event can be described as a cloudburst?

- **Cloudburst has a very specific definition:** Rainfall of 10 cm or more in an hour over a roughly 10 km x 10-km area is classified as a cloudburst event. By this definition, 5 cm of rainfall in a half- hour period over the same area would also be categorized as a cloudburst.

How common are cloudbursts?

Cloudbursts are not uncommon events, particularly during the monsoon months.

- Most cloudbursts happen in the Himalayan states where the local topology, wind systems, and temperature gradients between the lower and upper atmosphere facilitate the occurrence of such events.

- However, not every event that is described as a cloudburst is actually, by definition, a cloudburst. That is because these events are highly localized. They take place in very small areas which are often devoid of rainfall measuring instruments.

What are the consequences of cloud bursts?

Consequences of cloudbursts are not confined to small areas.

- Because of the nature of terrain, the heavy rainfall events often trigger landslides and flash floods, causing extensive destruction downstream. This is the reason why every sudden downpour that leads to destruction of life and property in the hilly areas gets described as a "cloudburst", irrespective of whether the amount of rainfall meets the defining criteria. At the same time, it is also possible that actual cloudburst events in remote locations aren't recorded.

Can cloudbursts be forecast?

- The India Meteorological Department forecasts rainfall events well in advance, but it does not predict the quantum of rainfall — in fact, no meteorological agency does. The forecasts can be about light, heavy, or very heavy rainfall, but weather scientists do not have the capability to predict exactly how much rain is likely to fall at any given place.
- Additionally, the forecasts are for a relatively large geographical area, usually a region, a state, a meteorological sub-division, or at best a district. As they zoom in over smaller areas, the forecasts get more and more uncertain. Theoretically, it is not impossible to forecast rainfall over a very small area as well, but it requires a very dense network of weather instruments, and computing capabilities that seem unfeasible with current technologies.
- As a result, specific cloudburst events cannot be forecast. No forecast ever mentions a possibility of a cloudburst. But there are warnings for heavy to very heavy rainfall events, and these are routinely forecast four to five days in advance. Possibility of extremely heavy rainfall, which could result in cloudburst kind of situations, are forecast six to 12 hours in advance.

Are cloudburst incidents increasing?

- There is no long-term trend that suggests that cloudbursts, as defined by the IMD, are rising. What is well established, however, is that incidents of extreme rainfall, as also other extreme weather events, are increasing — not just in India but across the world. While the overall amount of rainfall in India has not changed substantially, an increasing proportion

of rainfall is happening in a short span of time. That means that the wet spells are very wet, and are interspersed with prolonged dry spells even in the rainy season.

- This kind of pattern, attributed to climate change, does suggest that cloudburst events might also be on the rise.

Sharad

Nasal Covid Vaccine

News: India gets its first nasal covid vaccine.

GS Paper 3: Science and Technology- Developments and their Applications and Effects in Everyday Life; Achievements of Indians in Science & Technology; Indigenization of Technology and Developing New Technology.

About India's first intra-nasal vaccine for COVID-19:

- Bharat Biotech's ChAd36-SARS-CoV-S COVID-19 (Chimpanzee Adenovirus Vectored) is India's first intra-nasal vaccine that will be delivered through the nose instead of a shot in the arm.
- Product name is iNCOVACC
- The vaccine has received approval from the country's apex drug regulator Central Drugs Standard Control Organisation (CDSCO) for emergency use in adults.
- This vaccine has been developed by Bharat Biotech with technology in-licensed from Washington University-St Louis,
- It has been approved for primary immunisation, meaning it can be given to the unimmunised to protect against Covid-19.

Bharat Biotech's statement on iNCOVACC:

- iNCOVACC is a recombinant replication-deficient adenovirus vectored vaccine with a pre-fusion stabilized spike protein. This vaccine candidate was evaluated in Phase-I, II and III clinical trials with successful results. iNCOVACC has been specifically formulated to allow intra-nasal delivery through nasal drops. The nasal delivery system has been designed and developed to be cost-effective in low- and middle-income countries.

Trials for Booster:

- The company found the vaccine to be "safe, well-tolerated, and immunogenic" when compared to its own Covaxin in a phase III trial of nearly 3,100 participants across 14 sites in India. The company has also conducted a trial with 875 participants to see whether the vaccine may be used as a booster in those who have received Covaxin or Covishield as their primary vaccine.

What are the benefits of nasal vaccines over conventional vaccines?

- **No need for needles:** With the vaccine being delivered through a nasal spray, it will do away with the need for needles and syringes currently required for all the Covid-19 vaccines available.
- It will also reduce dependence on personnel trained to give shots.
- **Nasal vaccine triggers an immune response in the mucosal membrane:** Being an intranasal vaccine, Bharat Biotech's intranasal Covid vaccine (BBV154) may produce local antibodies in the upper respiratory tract which may provide the potential to reduce infection and transmission.
- **Pave way for efficient distribution and easy administration of COVID-19 Vaccination:** As iNCOVACC has been designed for efficient distribution and easy administration. Product is stable at 2-8°C for easy storage and distribution.
- **iNCOVACC enables mass immunisation through easy nasal delivery.**Hence , It promises to become an important tool in mass vaccinations during pandemics and endemics.
- It protects from emerging variants of concern by enabling faster development of variant-specific vaccines.

Studies in support of Nasal Vaccine for COVID-19:

- A study published in Science Direct showed the pre-clinical efficacy of a lentiviral vector, delivered nasally, as a COVID-19 vaccine. The authors said targeting the immune response to the upper respiratory tract

provides critical protection, and intranasal vaccination induces protective mucosal immunity against the SARS-CoV-2 in rodents. Given that the SARS-CoV-2 virus shows a proclivity to dwell in the upper respiratory tract for a prolonged period of time, a safe and efficacious nasal vaccine is well-placed to target the literal entry point of the virus into the body.

- Researchers at Lancaster University working with the Biomedical Research Institute in Texas claimed they had administered two doses of a COVID-19 vaccine via a nasal spray in animals, and this had elicited robust antibodies and T-cell responses that were enough to be able to neutralise SARS-CoV-2.

Studies that are apprehensive about suitability of nasal vaccine for COVID-19:

- A study from Washington University found that while a COVID-19 vaccine injection (at that stage) induced an immune response that prevented pneumonia, it did not prevent infection in the nose and lungs. Such a vaccine might reduce the severity of COVID-19, but it could not prevent infected individuals from spreading the virus, said the study.

Are there other such nasal vaccines?

- So far, intranasal vaccination is being used only for influenza. However, it cannot be used on certain groups of people, particularly those who have compromised immune systems.
- Science Daily reports that "the new COVID-19 intranasal vaccine in the Washington University study does not use a live virus capable of replication, presumably making it safer". The Bharat Biotech vaccine also rides on an adenovirus vector.

Sharad