

Sales Promotion and Marketing Strategy of Nano Urea (liquid)

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Abstract

Nano Urea (liquid) is the fertilizer of the 21st century. Since long, nanotechnology based solutions have been commercially applied in areas of medicine, aerospace, defence, pollution control, electronics, sensor-based technologies, paints, etc. Nanotechnology has been breaking new barriers in many fields but its application in agriculture has been limited. IFFCO through its Nano Biotechnology Research Centre (NBRC) at Kalol has undertaken research and development of nano-fertilizers. Nano-fertilizers can lead to economy in application of nutrient fertilizers, better crop harvests with minimal environment footprint. For this, extensive field trials and lab testings have been conducted to ascertain efficacy- biosafety- bio toxicity of nano-fertilizer. Concentrated efforts by IFFCO since 2017-18 have resulted into introduction of world's 1st nano-fertilizer - Nano Urea (liquid) for the farmers. It had also been notified under Fertiliser Control Order (FCO) of Government of India. Real challenge for any novel product lies in its acceptability by the customer for which channel partners are also being sensitised. IFFCO enjoys support of primary agriculture cooperative societies (PACS) which form its robust channel partner network at grassroots level. Apart from PACS, alternative channels such as IFFCO bazar, IFFDC societies, farmers service centres (FSC), digital marketing platform are also being explored to disseminate the benefits of Nano Urea (liquid) in short time. To achieve this objective effectively, innovative sales promotion and marketing strategy is being employed. Nano Urea (liquid) fulfils the ideology of 'Make in India and Made for the World'. National and international tie ups/ MoUs/ JVs with cooperatives and dealers in India and abroad are steps in this direction. Paper summarises the publicity, promotional and extension efforts of IFFCO for Nano Urea (liquid) so that farmers can harness its benefits, improve their profitability and also benefit the environment during the process.

Key words: Nano urea liquid, nano technology, joint ventures, MoUs, promotion, publicity, marketing, way forward

Introduction

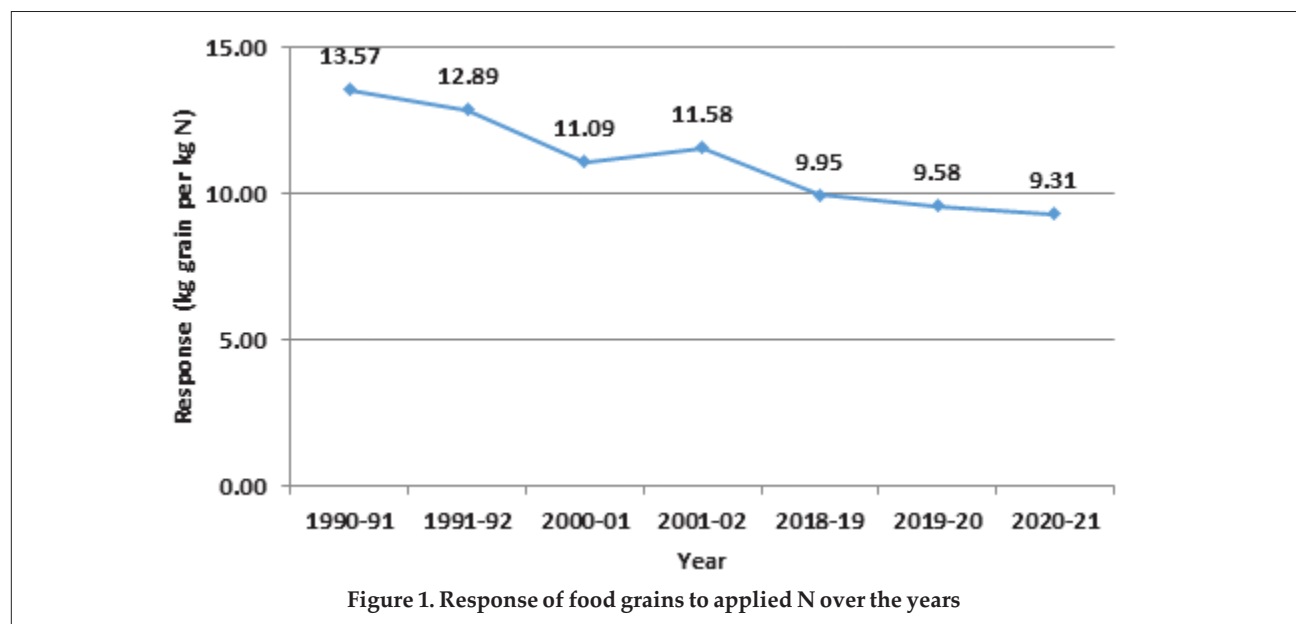
Agriculture remains the backbone of Indian economy, a fact that has been demonstrated well even during Covid-19 pandemic. Today, consumer is concerned about food traceability, environment friendly agri-inputs, soil and environment health and sustainable farm operations. This calls for novel and innovative solutions to address these challenges. Nitrogen (N) is one of the most essential and structural nutrient required for better crop growth and development. Though, it is abundantly available in atmosphere (78 %) but its unavailability in soils results in suboptimal or reduced yields. Low carbon status due to intensive crop cultivation practices and reduction in soil organic matter (SOM) have disturbed the C: N ratio of soils. Plant requirement for N is largely met by urea and this is the farmer's first choice which is now becoming a habit at the cost of balanced fertilizer application over the years. It's low cost, ease of application and visible responses have been some of the factors for its adoption. With nitrogen use efficiency (NUE) of 30 to 50%; urea losses are getting substantial over a period of time. Urea's ill effects due to excess application in terms of prevalence of pests and diseases, crop lodging, delayed maturity and soil-air- and water- pollution had been well documented.

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A Few Facts about Urea

In India, urea accounts for 80% of the nitrogenous fertilizers applied to crops by farmers. There has been commensurate increase in production, import and consumption of urea over the years. If we see the trend in urea consumption in India over the years, the compound annual growth rate from 1990-91 to 2020-21 works out to be 3.1 per cent. On the other side if we take into account the production of food grains and consumption of N (FAI, 2020; 2021) and assume that 40% increase in food grain production is on account of N application and considering that 65% N is going to food grain crops, the response ratio (kg grain kg N⁻¹) is showing a declining trend (**Figure 1**). It suggests that with commensurate increase in application of nitrogenous fertilizers such as urea, we may not be able to sustain higher food grain production in perpetuity. Therefore, contingent measures have to be taken for ensuring sustainability of our food grain production systems.

Application of urea though is essential for the food security of the country but its production and distribution is both energy and resource intensive. Out of the total demand of 35.04 million MT of urea in India, about 72% was met through indigenous production while 28% was from imported urea in 2020-21 (FAI, 2021). During 2020-21, out of the total



urea consumption of 35.04 million MT, production was 24.6 million MT while import was 9.83 million MT. Imported quantity of urea during 2020-21 was almost four times than the quantity imported during 2005-06. This shows increasing import dependency to meet the higher urea demand of farmers at higher economic cost for the country.

There has been inter- state, -district, -crop -area and –village variation in fertilizer consumption inclusive of urea consumption. The same should be properly addressed by all concerned. Balanced use of fertilizers is key to enhance farm productivity and for sustainable soil health. Fertilizer consumption in India is imbalanced and skewed in favour of urea-N. All India NPK consumption ratio has widened from 4:3:2:1 in 2009-10 to 6.5:2.8:1 in 2020-21 (FAI, 2020, 2021). The farmers are using more urea at the cost of P&K fertilizers. Nitrogen application has to be balanced in higher application states and to be increased in the lower application states. Urea consumption scenario, its dynamics across the country have to be understood for bringing effective corrective solutions. Incidentally, green revolution states having predominant rice-wheat cropping system have more consumption of urea.

Out of 35.0 million MT of urea consumed across India during 2020-21, Uttar Pradesh, Madhya Pradesh, Punjab, Gujarat, Maharashtra, Telangana, Andhra Pradesh, Rajasthan, Haryana, Karnataka, Bihar and West Bengal are the leading states while north east and hill states were lowest in consumption. If we analyse the urea consumption in terms of per unit gross cropped area; it is evident that states like Punjab, Haryana, Bihar, Telangana, Uttar Pradesh and Uttarakhand use urea more than 230 kg ha⁻¹ (Table 1). First four states have consumptions more than 300 kg ha⁻¹. NPK ratio is highly skewed in states like Punjab, Haryana, Uttar Pradesh and Uttarakhand. Further, it is also distorted in Rajasthan (50.4:20.7:1), Jharkhand (25.2:10.2:1), Madhya Pradesh (12.4:7.3:1) and Gujarat (9.9:3.4:1). This disparity is more evident if district-wise and crop-wise scenario is analysed. It has wide implication in terms of soil health and environment pollution; gap in crop productivity and declining factor productivity in agriculture.

Ensuring healthy environment and soil-crop-atmospheric biodiversity in perpetuity is a common agenda for most of the nations. India too as a responsible nation is concerned about soil health, climate change and global warming issues. Urea is a major source of nitrogen pollution (NO₃⁻, NH₃,

Table 1. State-wise scenario of urea consumption in India in 2020-21 (Source: FAI, 2021)

Urea consumption	Punjab	Haryana	Bihar	Telangana	Uttar Pradesh	Uttarakhand	All India
Million MT	2.94	2.15	2.33	1.75	7.41	0.24	35.0
Per unit of gross cropped area (kg ha ⁻¹)	377.5	325.9	314.6	303.7	275.9	232.9	173.8
NPK use ratio	27.0 : 6.9 : 1	28.2:8.1:1	7.7: 2.7 : 1	6.8 :2.7 : 1	16.6 : 6.0 : 1	14.4 : 3.5 : 1	6.5: 2.8 : 1

N_2O) and its application has to be rationalized. To address these concerns, Indian Council of Agricultural Research and fertilizer industry have also researched and introduced slow and controlled release fertilizers namely, *neem* coated urea, sulphur coated urea, granular urea, urea super granule. Various nitrification and urease inhibitors have also been experimented with but were not accepted because of price affordability or unease in application. Further, decision support systems based on soil test based fertilizer management, site specific nutrient management, integrated nutrient management, leaf colour chart, green seeker, etc. are also in operation for better nitrogen management. Nutrient efficient products and technology requires acceptability at farmer's level and demonstrated benefits to sustain their interest. Many European and Asian countries like China and Sri Lanka are also moving towards reduction in chemical fertilizer usage. Consumers are preferring organic or residue free agriculture with minimal environment footprints. This calls for continuous innovation in agriculture and novel measures on the ground that can lead to reduction in chemical fertilizer application.

Nanotechnology-based Nano Fertilizers for Agriculture

Nanotechnology is a promising field of research widely adopted by developed countries and resource poor countries for providing 'Out of Box' solutions to problems faced by humanity. Nano nutrients have small size (1–100 nm) which imparts unique characteristics and benefits. Their large surface area to volume ratio offers opportunity for better and effective interaction at target sites. Once inside the plant system, these trigger or signal nutrient pathways resulting into higher crop productivity even at reduced nutrient doses. Introduction of advance fertilizers like Nano Urea (liquid) and its sale through farmer's cooperative societies and retailers weans farmers away from conventional urea.

Nano Urea (liquid) - Worlds 1st Approved Nitrogenous Nano-fertilizer

Advent of smart fertilizers like nano-fertilizers has made 'Ever Green' revolution in agriculture a distinct possibility. Enhancing nutrient use efficiency has become critical for our food production systems. With the introduction of Worlds 1st nano-fertilizer as IFFCO Nano Urea (liquid) an era of high impact, low environment footprint fertilizers has dawned. It opens a new chapter in plant nutrition, crop management and farmers' awareness all over the world. Nano Urea (liquid) has benefit of precision and targeted application with an efficiency of more than 80% and

promises to be a potential source of nitrogen nutrition to crops. Its production process is also environment friendly and has advantage in terms of logistics and warehousing too. Manufacturing plant of Nano Urea (liquid) can even be initiated in areas where earlier urea production was not possible because of energy or natural gas limitation.

A lot of work has been done globally, including India, on development of nano-products. However, safety issue remains the main bottleneck in their commercialization. In year 2020, IFFCO submitted a proposal for inclusion of its three products (Nano nitrogen, nano zinc, nano copper) in FCO. IFFCO nano nitrogen, nano zinc and nano copper have been evaluated and validated according to 'Guidelines for Evaluation of Nano-based agri-input and food products in India' released by the Department of Biotechnology, Government of India. Department of Biotechnology guidelines are harmonised in tune with international/OECD protocols. On-station and on-farm trials of Nano Urea (liquid) had demonstrated its field efficacy across 11,000 locations and 94 crops. Quality of harvested food produce had also been found to be better due to application of Nano Urea (liquid). Subsequently, Nano Nitrogen had been brought under Fertiliser (Inorganic, Organic, or Mixed) (Control) Order, 1985, in Schedule VII. General specifications of Nano Nitrogen under head Nano Fertilizer both in liquid and solid were notified vide S.O. 884 (E) dated 24th February, 2021. Further on the same date in pursuance of clause 20D of the Order, vide S.O. 885 (E), Department of Agriculture, Cooperation and Farmers Welfare notified the specifications of Nano Urea (liquid) to be manufactured by IFFCO for a period of 3 years.

With the introduction of nano-fertilizers like Nano Urea (liquid), effective nitrogen (N) management is possible in the crops. One 500 ml bottle of Nano Urea (liquid) can replace at least one bag of top dressed nitrogenous fertilizers like urea based on its performance and efficiency. It has been priced 10 % lower than the cost of one bag of urea. It can provide a viable and informed alternative for foliar application of N to crops rather than the soil without compromising on the yield.

With the introduction of digital technologies in agriculture and technology package in terms of spraying solutions through drones/UAVs/precision sprayers; liquid fertilizer like Nano Urea (liquid) will soon become integral part and parcel of our diverse crop production systems. It can replace a portion of excess urea applied in our crop fields and also where availability of conventional urea has been a limiting factor. Environment friendly Nano



Photo 1. MoUs between IFFCO-NFL and IFFCO-RCFL for technology transfer of Nano Urea (liquid) production

Urea (liquid) can play an important role in ensuring food and nutritional security of the nation.

Sales Promotion and Marketing

Nano Urea (liquid) is a nano-fertilizer and a new product genre. It is for the first time in the world that commercial production of this fertilizer has started by effectively scaling the production process from lab to the plant stage.

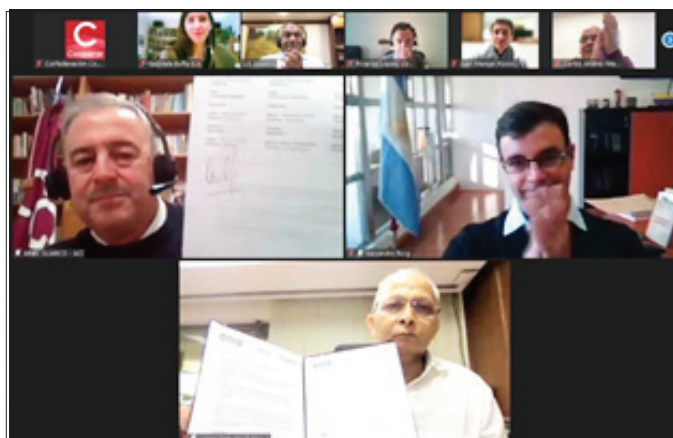
IFFCO Nano Urea (liquid) Plant: IFFCO Nano Urea (liquid) plant at Kalol became operational on 1st June, 2021. Production capacity of the plant is 1.5 lakh bottles per day. In due course of time, 4 more plants would be constructed. For scaling up the production of Nano Urea (liquid), Ministry of Chemicals and Fertilizers had signed two MoUs for technology transfer of this product *i.e.* MoUs between IFFCO and National Fertilizers Limited (NFL), and between IFFCO and Rashtriya Chemicals and Fertilizers Limited (RCFL). A snapshot of the MoUs is shown in **Photo 1**. These MoUs will further scale up the production of Nano Urea (liquid) in the

country. Besides, states of Assam, Telangana and Karnataka have also expressed willingness to set up plants of this new genre product.

MoU & JVs with Foreign countries: Nano Urea (liquid) is reaching out to other countries. MoUs had been signed between IFFCO and two cooperatives - INAES and Cooper of Argentina Organization and also between IFFCO and Brazilian Cooperatives, OCB (**Photo 2**). They will also be working together for setting up this fertilizer manufacturing plant in their countries *i.e.* Argentina and Brazil.

Reaching Newer Markets – Export of Nano Urea (liquid)

Nano Urea (liquid) is in demand by many countries. The Department of Fertilizers (DOF), Ministry of Chemicals and Fertilizers has accorded permission to IFFCO to export Nano Urea (liquid) fertilizer with conditions: (i) Total export will not exceed 20 per cent of the total production of Nano Urea (liquid) fertilizer in a year; (ii) No subsidized raw material (fertilizer/urea) will be used for the production of Nano Urea



2a



2b

Photo 2. Snapshots of MoUs between IFFCO and two cooperatives - INAES and Cooper of Argentina Organization (2a) and IFFCO and OCB, Brazil (2b)

(liquid) fertilizer; and (iii) IFFCO may approach the DOF for grant of NOC on case to case basis in prescribed proforma as per DGFT Notification dated 7th January, 2019. Nano Urea (liquid) can now be exported to other European countries, America, Sri Lanka, Nepal, Thailand, Kenya, Tanzania and Canada as requested by IFFCO.

Expanding the Indigenous Marketing Reach

IFFCO, through its robust network of 36,000 primary agriculture cooperative societies (PACS) and 103 farmer service centre (FSC), is marketing Nano Urea (liquid) to the farmers. Apart from this, IFFCO's JVs/subsidiaries sale points such as 2,050 IFFCO bazar centres, 8369 IFFDC societies; and CSC kisan points are also providing valuable services to farmers besides, selling nano urea (liquid). There are more than 3 lakh CSC – VLEs in operation across the country. Current marketing efforts have helped Nano Urea (liquid) reach out to 250 districts and 4,326 sale points (Table 2) and to more than 15 lakh farmers of the country.

Digital marketing initiative of IFFCO through www.iffcobazar.in has also made available Nano Urea (liquid) across 26,000 pin codes of the country. Within two weeks of launch on 8th July 2021; Nano Urea (liquid) became the highest sold item on iffcobazar.in. Currently, through this online platform 1,925 districts of 34 states & UTs have been covered.

Nano Urea (liquid) is strategically priced @ Rs 240 (10 % lower than one bag (45 kg) of urea @ Rs 266.50/-). Incentives are provided to channel partners for

facilitating farmers in spraying operations at nominal cost. They are also educated regarding salient features of Nano Urea (liquid) and its application in agriculture for getting better net returns. Support has been provided to the channel partners by supplying about 1 lakh battery operated sprayer pumps with spare batteries, mask and other accessories. Other spraying options and models for promoting spraying are being explored to help the channel partners and sellers to enhance reach of Nano Urea (liquid). This will incentivize farmers to use this product and also provide them with much needed support in terms of better service on hired basis.

Farmers can easily carry or stock Nano Urea (liquid) bottles. Packing size has been determined as per the farmer's demand *i.e.* 24 bottles/carton or 12 bottles/carton. Packaging is also made attractive to catch attention of the farmers. Promotional campaigns are being organized with the channel partners to persuade farmers by demonstrating them the benefits of this new product. Timely demand and supply is ensured through online indenting and by adopting effective movement strategy as it is not a bulk commodity. IFFCO is ensuring the supplies to the sale points/demand place in the earliest possible time. Handling & Transportation and C&F agents are also playing vital role in effective delivery system.

Effective Sale, Publicity and Promotional Programmes

For successful introduction of any new product, awareness among the farmers has to be created by various programmes. Any new product or technology inadvertently follows the path of adoption in step by step process *i.e.* Awareness - Interest - Evaluation - Learning - Trial - Adoption (AIELTA) cycle. At each of these conjectures, respective promotional and extension programmes and sale promotional and marketing strategy is employed for deriving maximum adoption. Thus, a holistic strategic plan was chalked out by IFFCO by using different scientific and marketing principles to take the product benefits to the channel partners, sale point personnel/dealers, policy makers, researchers and farmers in a systematic manner.

IFFCO has popularized the Nano Urea (liquid) and is selling it through its market channel and selling out of its marketing channel for realizing immediate sales and feedback. Farmers are encouraged to purchase it by undertaking sales campaigns and providing incentives to 'Buy now'. Sales promotion complements advertising which is being taken up at local, national and international levels. IFFCO has deployed effective sales, publicity and promotional efforts for popularizing Nano Urea (liquid) through a series of

S.No.	States/UTs	Districts covered	Societies/sale points
1	Andhra Pradesh	6	57
2	Bihar	17	190
3	Chhattisgarh	7	147
4	Gujarat	36	221
5	Haryana	22	528
6	Himachal Pradesh	5	183
7	Jammu & Kashmir	2	61
8	Jharkhand	3	101
9	Karnataka	17	608
10	Kerala	3	23
11	Madhya Pradesh	30	490
12	Maharashtra	29	359
13	Odisha	14	78
14	Rajasthan	15	273
15	Tamil Nadu	16	206
16	Telangana	8	47
17	Uttar Pradesh	13	624
18	Uttarakhand	4	82
19	West Bengal	3	48
	Total	250	4326

programmes (Figure 2). Simultaneously, promotion and market development programmes are also being undertaken.

Crop Demonstrations: India is bestowed with more than 200 crops which have distinct agronomies. In tune with the concept of 'Seeing is Believing' IFFCO had conducted on-farm and on-station trials in major agro-climatic regions and on major crops of the country. Research trials at farmers' fields have been conducted in more than 94 crops in 15 agro-climatic regions of the country. Progressive and nearby farmers have also visited these trials which helped in generating interest and awareness about the product.

Short video films of Nano Urea (liquid): Technical and educational videos of short duration (4-6 minutes) displaying the unique benefits and complete package of application of IFFCO Nano Urea (liquid) have been made available through online platforms. These

videos are being screened to farmers after keeping in view the existing COVID protocols either in physical form or are shared in farmer's friend Whats App groups. Farmers testimonial videos (120 seconds; 60 seconds) showcasing their experience and the benefits of this new fertilizer is also circulated to channel partners, cooperative officials and policy makers. To take advantage of the limited attention span of viewers, short clips or 'Feeler' Videos of Nano Urea (liquid) (20-30 seconds) have been created. These videos are being screened or showcased at social, mass media and digital platforms at national and international cooperative platforms at seminars, symposiums and workshops. Product details are communicated to the farmers visiting farmers' haat, agriculture fairs and village community centres. IFFCO journey of R& D, production and marketing has been shot by DD Kisan for the benefit of farmers and other stakeholders. This film will be showcased to viewers as an innovation of 'New Bharat' for the



benefit of farmers of the nation.

Print & Electronic Media: The product promotion through print and electronic media has been extensively undertaken. Press releases in the print and digital media have been a regular occurrence. Advertisements have been printed in leading newspaper and also displayed on social media and digital network. Farmer's success stories about use of Nano Urea (liquid) have found mention in leading newspapers as well as in agriculture centric regional and local newspapers. Webinar on Nano Urea (liquid) have been conducted in collaboration with State Agricultural Universities in presence of Vice Chancellor and leading agricultural scientists and cooperators. Benefits, application methodology and other details of the fertilizer are discussed and viewer's queries are suitably answered during the webinars. Research work done by the scientists is documented in form of research as well as popular articles in local/regional magazines, newspapers, periodicals, etc. They act as a reference point for gaining knowledge and understanding about Nano Urea (liquid). Special dedicated issues of popular magazine/periodicals on nano-fertilizers are being brought out highlighting case studies/success stories of Nano Urea (liquid).

To catch the imagination of young and impressionable minds, Nano Urea (liquid) awareness programmes/quizzes are being conducted in village schools. Advertisements on All India Radio/Community Radio/Regional Channels are integral part of sales promotion and marketing efforts of Nano Urea (liquid). Information about Nano Urea (liquid) has been covered by international media also.

Mass Media Campaigns: Mass media campaigns are integral part of publicity and promotional efforts for Nano Urea (liquid). Audio visual and publicity vans are in operation for promotion and last mile delivery of product and services. Progressive and entrepreneur farmers work as brand ambassador. Different aspects of application of Nano Urea (liquid), its content and benefits for the farmers and the environment are emphasized. Nano Urea (liquid) news is also played as breaking/ troll news at the bottom of national/ regional news. Selective SMS messages are being sent to IFFCO progressive farmers informing them about availability of this product. Radio Jingles /Audio Clips / Songs in local language are played at premium time at regional / All India Radio while audio messages are also circulated in various farmers Whats App groups.

Nano Urea (liquid) is displayed as profile display picture and as cover page of social media sites (such as Facebook, Twitter, Instagram, Whats App of employees of IFFCO and its subsidiaries/JVs as well

other stakeholders. These cover pictures also have relevant content messages showing the benefits of nano fertilizer.

Publicity matter for creating awareness campaigns in form of catchy poems, couplets and slogans are being circulated or displayed at appropriate platforms related to salient features of the product associated with farmers. Banners (**Photo 3**) and posters are displayed at prominent places in addition to wall/ tractor trolley/bus panel/ rickshaw/three-wheeler paintings, hoardings, etc. Digital displays are placed at vantage and strategic points and also at places registering maximum farmers footfalls viz. at all sale points as shown in, farmer friend clubs; krishi vigan kendras; farmers stores; Common Service Centres; farmer producer organizations, kisan mandis and haats, etc.

IFFCO is also sponsoring Nano Urea (liquid) specific shows, skit, street plays and local vocal groups. Spray campaigns are being carried out where spraying cost is subsidized in line with size of landholding and group spraying or mass crop spraying operations are undertaken at farmer's plots. The awareness programmes are being conducted in the sidelines of important national / international programmes such as Amrut Mahotsav; Earth Day; World Environment



Photo 3. Display of banners at sale points

Day, World Food Day, etc. Dispatches of Nano Urea (liquid) from Kalol plant were started on 5th June 2021 (World Environment Day).

Publicity Material, Gifts & Awards: Cooperatives and other sale points have been provided with publicity material such as stickers, display charts, brochure, pamphlets, literature of Nano Urea (liquid) ; replica and souvenir of Nano bottles; T-shirts, Caps, key chains, umbrella, toran, etc. Samples of Nano Urea (liquid) and brochures / folders are provided to dignitaries and scientists. Progressive farmers

engaged in its promotion are honored at various forums.

Dedicated Internet Site: Dedicated internet site have been created for Nano Urea (liquid). This is the 1st product based platform created by IFFCO. Site is operable on all kind of internet platforms and is android / iOS-based. It works as a knowledge resource and repository on Nano Urea (liquid), its benefits, journey of IFFCO in nanotech space, nano-fertilizers, farmers' testimonials, endorsements by public figures and opinion leaders. Apart from resources and documents specific to the product which are required by a user and buyer; a photo gallery depicts programmes being organized for Nano Urea (liquid). Queries of the visitors are also addressed. Videos of Nano Urea (liquid) usage and benefits are also available at the site.

Training & Awareness programmes: Nano Urea (liquid) is an innovative and novel product. Therefore, for its proper knowledge and awareness, training programmes are regularly being organised at district/block / village level / cooperative / retailer level exercising COVID protocol. The trainings and workshops, symposium, webinar, panel discussion, 'Live in' and 'Stream in' programmes are being organised. These training programmes address the problems faced by agriculture in general and environment in particular and how Nano Urea (liquid) can help mitigate some of the ill effect of intensive agriculture practices. Participants are also made aware of the safety aspects and precautions which need to be exercised. Feedback

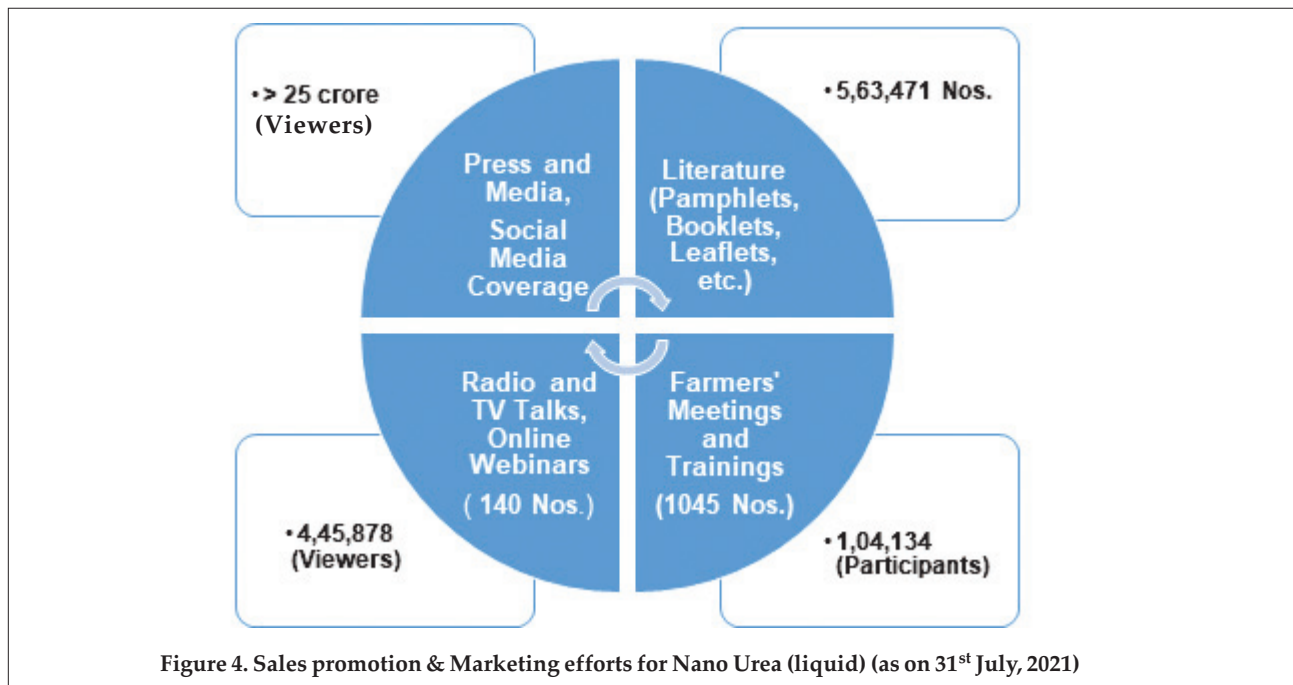
of the training is collected from trainees for possible corrections and advancement. Trainers of these training programmes are IFFCO officials and technical and extension experts from research institutes, state agriculture universities and ICAR-Krishi Vigyan Kendras. Emphasis is also being given on training of the trainers. Participants of these programmes besides farmers are technical & extension experts; nanotechnologist; public figures; opinion leaders & influencers; celebrities; entrepreneurs; government officials; environment experts; vice-chancellors; directors of SAUs / Research Institutes etc. Nano Urea (liquid) is also being noticed and mentioned by premium research institutes engaged in nanotechnology such as Indian Institute of Technology, New Delhi.

State-wise Flag off Programmes & Endorsement by Opinion Leaders, Government Officials and Scientists:

Unique state-wise flag off programmes involving Chief Minister, Agriculture Minister, Agriculture Commissioner, Director, Agriculture, cooperative leaders, important dignitaries of concerned states have been undertaken for 17 states/UTs (**Photo 4**). This has resulted into sensitisation of the state machinery, agricultural department, channel partners, production and distribution network in regard to Nano Urea (liquid) supply and availability as well as its promotion amongst farmers and channel partners. Agriculture department of the states are also conducting trials at state farms and at farmers' fields. Some states are also helping increase the acceptability of Nano Urea (liquid) by



Photo 4. Flag off programmes of Nano Urea (liquid)



sharing information about the product, conducting demonstrations and by promoting it amongst the farmers.

Achievements of the Efforts and MoUs for Futuristic Research

Sales promotion and marketing efforts of IFFCO have resulted into enhanced awareness about Nano Urea (liquid). As on 31st July 2021, IFFCO efforts in pitching the product campaign wide coverage through press, media and social media have helped to reach out to 25 crore viewers (**Figure 4**). 5.63 lakh copies of literatures on Nano Urea (liquid) has been printed and distributed in different local languages. Webinars / radio & TV talks have benefited more than 4.45 lakh viewers. Farmers meetings, trainings have directly helped to reach out to 1.4 lakh farmers. For providing impetus to research efforts, IFFCO MoU with Indian Institute of Technology, Delhi for research consultancy, knowledge transfer and collaborative projects was formalised on 20th July 2021. This will facilitate advanced research in the area of nanotechnology for futuristic applications.

Way Forward

India is an agrarian country and agriculture provides food and livelihood security to majority of the population. With the intensification of agriculture and limited land and other resources, economy in use of inputs is of vital importance. Environment cost of imbalanced application of agri-inputs like chemical fertilizers has compounding effect. Recent report by Intergovernmental Panel on Climate Change (IPCC) has been rightly said as "a code red for humanity".

Global temperatures have already risen by 1.1⁰ Celsius since the 19th century. Thus, environment is becoming first priority and every citizen and industry in the country have to play their own part.

Indiscriminate and excessive application of fertilizers such as urea needs to be balanced for ensuring agriculture sustainability. Scientists have evolved slow and controlled release and enhanced efficiency of fertilizers for addressing low and declining use efficiency of nutrients. Though the technology has its benefits but high cost and acceptability at farmers level is a key deterrent. This certainly shifts focus towards other high tech but affordable agri-inputs which can lead to rationalisation in application of chemical fertilizers. Here, nanotechnology has come as a saviour as it can play unique role due to their size, shape and effect. This has motivated innovators to utilise nanomaterial to solve the problems faced by mankind. Smart and intelligent nutrient management with the use of nano-fertilizers has the potential to re modulate the concept of integrated nutrient management. It fulfils its utility as a part of 4 R nutrient stewardship by promoting precision and targeted application of nutrients.

Nano Urea (liquid), recently notified in FCO, is a step in this direction. Novel methods to enhance nutrient use efficiency have to be brought in for bringing the desired outcome. Nano Urea (liquid) is in sync with the vision to improve our soil health, reduce soil, air and water pollution and enhance farmer's profitability. This fertilizer has to be synchronised with the package of practices of different crops for its

wider applicability. To enhance confidence in nanotechnology and its widespread adoption, continuous studies on nanomaterial's residual effect, impact on soil fertility and productivity in long-run is equally important.

Sales promotion and marketing of Nano Urea (liquid) require same nationalistic fervour and cooperation as was evident at the time of Green Revolution to address challenges being faced as a result of modern day agriculture. Robust promotional and extension programmes can create awareness amongst the farmers and the channel partners, state agriculture department and ICAR institutes become relevant for the successful outcome in introduction of nano-fertilizers. ICAR research institutes and state agriculture universities can guide in bringing out a detailed application programmes for nano-fertilizers for the whole country. Department of farm mechanisation can help in designing better spraying solutions as per crop and geography. Spraying options such as boom sprayers, electrostatic sprayers, drone and battery operated sprayers in custom hiring mode can also promote nano-fertilizers. A community

based model for economising cost of spraying by utilising various modes and modules of spraying would be a best fit.

IFFCO has done all-round efforts to provide innovative solution to challenges being faced by modern day agriculture and for sustainability. It is high time that the like-minded institutions come together and usher an evergreen revolution based on nanotech based solutions. This will certainly lead to boom in agriculture productivity with no concomitant reduction in soil fertility and productivity. These conjoint efforts will certainly pave the way for 'Evergreen Sustainable Agriculture Revolution' that will lead to farmers' prosperity and environment safety.

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FERTILISER STATISTICS – 2019-20

FERTILISER STATISTICS - 2019-20 is a valuable repository of statistics regarding fertiliser, agriculture and allied statistics. The book is divided into three parts. *Part I* covers Indian Fertiliser Statistics and has two sections - *Section I* on Fertilisers and *Section II* on Raw Materials & Intermediates. *Part II* deals with Indian Agricultural and Allied Statistics. *Part III* presents World Fertiliser and Agricultural Statistics. The publication contains wealth of information regarding fertiliser and agriculture useful to a wide range of readers, including fertiliser manufacturers, importers, distributors, equipment manufacturers/suppliers, consultants, vendors, media, students, researchers and all those associated with the fertiliser and agriculture sectors.

Price of CD or hard copy

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