

Significance and Response about IFFCO Nano DAP in Punjab

Amrinder Singh and Gagandeep Singh
Indian Farmers Fertilizer Cooperative Limited (IFFCO) Punjab, India

ARTICLE ID: 42

The location of Punjab from both geographical and latitudinal points is such that the state experiences big alteration in temperature almost every month. The temperatures generally reach their maximum in the period from mid-May to June. The state experiences the minimum temperature in the period from December to February. Punjab mainly goes through three major seasons. Summer from mid-April to June end, Monsoon from early July to September end, and Winter from early December to February end. Punjab also observes transitional seasons apart from the main seasons. These seasons are the pre-summer season from March to mid-April and the post-monsoon season from September to November. The pre-summer season is the transition phase between winter and summer. The post-monsoon season is the transition between monsoon and summer. The highest recorded temperature in Punjab is 46.1 degrees Celsius and 0.2 degrees celsius in Ludhiana and Amritsar, respectively. The rainfall is received maximum in monsoon by the state and a little winter rain.

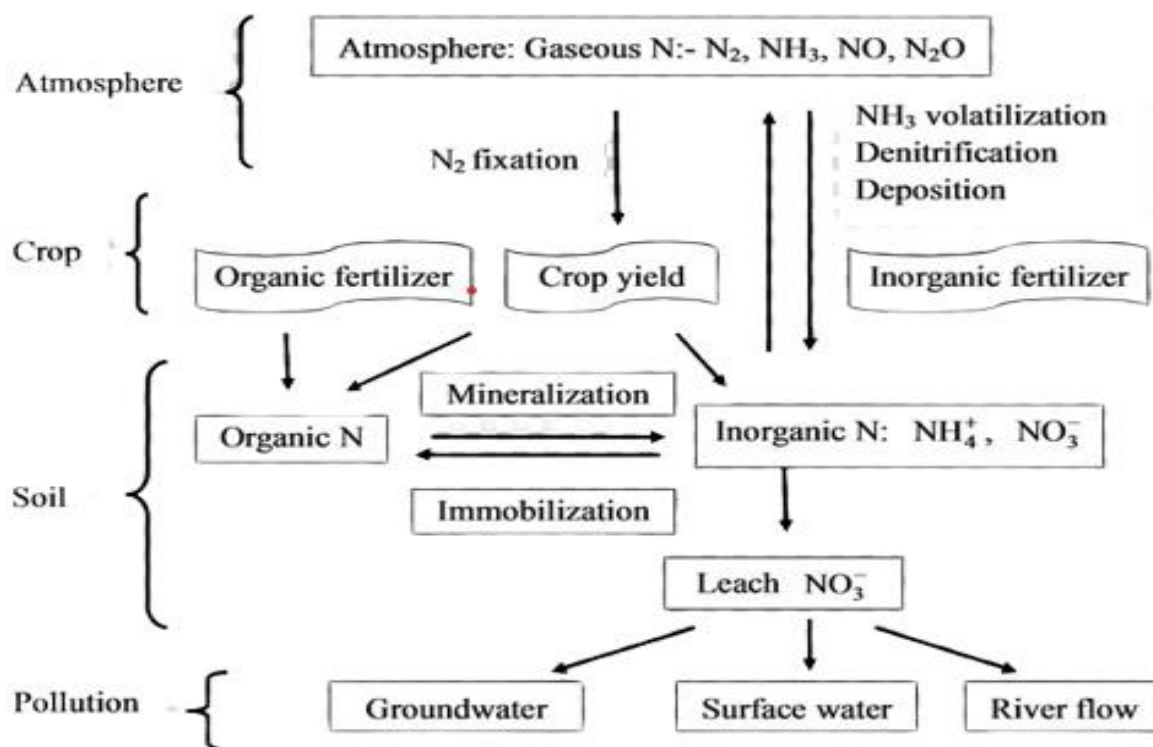
The climate of Punjab is changing unusually. Severe impacts of climate change on the temperature, groundwater discharge, precipitation, agriculture, and evapotranspiration. Urgent and effective steps must be taken to minimise such changes in the climate of Punjab and its effects. Punjab, well-known for its immense growth in the agriculture domain, is going through the need for intense water extraction, negligible forest cover, and excessive use of fossil fuels, making the state more affected by climate changes. In the last five decades, the wrong cropping patterns and urbanisation without proper planning have naturally led to the relentless use of resources. Due to this, large changes have occurred in the climate of Punjab. Abnormal rain patterns have affected crop yield and farmers' income at an extreme level. The frequent floods and droughts were not something the state used to experience a few decades ago. For instance, Punjab sometimes witnesses heavy rainfall in August, which is uncommon and a great concern for the state and the country. A clear strategy to maintain the climate of Punjab and avoid uncommon climate changes in the state is needed.



Punjab is one of the most fertile regions in India, where wheat, rice, sugar cane, fruits and vegetables are grown and it is called the “Granary of India” or “India’s bread-basket”. Rice and wheat are double cropped in Punjab with rice stalks being burned off over millions of acres prior to the planting of wheat. This widespread practice is polluting and wasteful. In Punjab the consumption of fertilizer per hectare is 223.46 kg as compared to 90 kg nationally. In recent years a drop in productivity has been observed mainly due to falling fertility of the soil, due to excessive use of fertilizers and pesticides over the years. In this article, we have discussed more details and excess load of fertilizer availability in agricultural purposes. The methodology of this article is to use the data of wheat yield and nitrate consumption. The correlation between nitrate consumption with wheat yield indicates the use of fertilizer in the case of state of Punjab of India.

Punjab has the highest per hectare consumption of ‘chemical fertilisers’ in the country. The consumption of fertilisers by nutrients — nitrogen, phosphate and potash — was 253.94 kg per hectare in the state for 2021-22. Union Minister for Chemical and Fertilisers Mansukh Mandaviya said, “Punjab is one of the states where production and productivity of wheat declined despite the higher use of chemical fertilisers. Therefore, we should save the soil by reducing the use of chemical fertilisers. It is high time that we should focus on soil health, which has deteriorated over the past few years.”

The subsidy amount on fertilisers has been slashed from Rs 1,40,122 crore in the 2021-22 budget to Rs 1,05,222 crore in the current budget 2022-23. A reduction in fertiliser subsidy by around Rs 35,000 crore as announced in the Union Budget is expected to hit Punjab real hard. The state, which is one of the highest per hectare consumers of fertilisers in the country, is set to lose almost Rs 3,141 crore on subsidy and this burden is likely to get transferred to farmers. The subsidy amount on fertilisers has been slashed from Rs 1,40,122 crore in the 2021-22 budget to Rs 1,05,222 crore in the current budget 2022-23 presented on Tuesday. This is a reduction of around Rs. 34,900 crores (25 per cent). Punjab with just 1.53 per cent area of the country has been using around 9 per cent of the total fertilisers, which include di-ammonium phosphate (DAP), urea, Muriate of Potash (MOP) and Super, used in India. It is one of the highest usages per hectare. Punjab’s loss would come to around Rs 3,141 crore, which is 9 per cent of the total reduction of Rs 34,900 crore in the subsidy amount.



Nitrogen is both an essential nutrient and a major pollutant in terrestrial ecosystems. As an integral component of essential plant nutrients, nitrogen plays an important role in increasing crop yields and crop quality. 78% of gaseous nitrogen (N_2), appears to be a virtually limitless reservoir, the very strong triple bond between the two nitrogen atoms makes this gas quite inert and not directly usable by plants and animals. Introduction of reactive nitrogen such as nitrate, ammonium (NH_4^+), or urea, which rapidly hydrolyses to form, to the terrestrial biosphere, that is, fertilization, has been recognized as the most effective method for increasing food production. However, excess nitrogen used in fertilization has undoubtedly disturbed the biogeochemical nitrogen cycle of natural ecosystems, resulting in various global, regional, and local environmental problems such as stratospheric ozone depletion, soil acidification, and especially pollution of ground and surface waters. In contrast to ions, ions are not adsorbed by the negatively charged colloids that dominate most soils. Therefore, ions move downward freely with drainage water and are thus readily leached from the soil. Such leaching losses not only cause several serious environmental problems, but also reduce ecosystem productivity.

As a result of the steady rise in world population, the demand for agricultural crops has increased drastically. Because of this, farmers have been forced to use conventional fertilizers and pesticides to increase their crop yield which contain chemicals that can be dangerous to

both humans and the environment. But in all of this, there's a positive development as well. The need for environmentally sustainable options has encouraged innovation and has led to Nanotechnology being applied to agriculture, thus resulting in Nano Fertilizers. With more than 54% of its land classified as arable, India is one of the leading agricultural-producing countries. In terms of employment, there are about 151 million who depend on agriculture and related activities for their livelihood. Overall, the agricultural industry contributes to about 18% of the country's GDP and this share increases every year with improvements in technology.

Due to this reason, the use of Nano Fertilizers in India is being highly encouraged by the Government. IFFCO Nano DAP is an efficient source of available nitrogen (N) and phosphorus (P₂O₅) for all the crops and helps in correcting the Nitrogen & Phosphorus deficiencies in standing crops. Nano DAP formulation contains Nitrogen (8.0% N w/v) and Phosphorus (16.0 % P₂O₅ w/v). Nano DAP (Liquid) has advantage in terms of surface area to volume as its particle size is less than 100 Nanometre (nm). This unique property enables it to enter easily inside the seed surface or through stomata and other plant openings. Nano clusters of Nitrogen and Phosphorus in Nano DAP are functionalised with bio-polymers and other excipients. Better spread ability and assimilation of Nano DAP inside the plant system leads to higher seed vigour, more chlorophyll, photosynthetic efficiency, better quality and increase in crop yields. Apart from this, Nano DAP through precision and targeted application fulfils the nutritional requirement of crops without harming the environment.

Nano fertilizers are incredibly efficient types of fertilizers that supply important macronutrients such as nitrogen to crops through small granules. Nano fertilizers were made available in India in the form of Nano Liquid Urea in 2022 by the Indian Farmers and Fertilizers Cooperative (IFFCO). IFFCO is a multi- state cooperative society in India that's engaged in the manufacturing of fertilizers, and this recent introduction has led to many benefits, including a reduction in the usage of urea by almost 50%. Some of the key benefits of Nano Fertilizers in India include: -

- ✚ **Increased Crop Yield:** One of the primary benefits of Nano Fertilizers is that it helps in growing healthier crops. The application of Nano fertilizers has demonstrated substantial increases in crop yields. By ensuring that plants receive the required nutrients precisely when they need them, these fertilizers foster optimal growth conditions, leading to more abundant harvests. The reduction in the excess usage of urea also results in stronger crops

and a higher yield. Further, this boost in productivity helps combat food security challenges, especially in densely populated countries, such as India.

- ✚ **Cost Effectiveness:** Although, compared to conventional fertilizers that are available in India, Nano fertilizers may seem like an expensive investment. However, their higher nutrient absorption and reduced wastage ultimately lead to cost savings for farmers. Moreover, their long-lasting effects reduce the need for frequent applications, making them more economically viable in the long run.
- ✚ **Environmentally Friendly:** Since Nano Fertilizers release nutrients gradually and directly to the plant roots, they minimize the environmental impact of agriculture. Their targeted application also reduces the need for excessive fertilizer use. Thus, the risk of soil and water contamination is reduced, resulting in the preservation of soil fertility and the promotion of sustainable farming practices.
- ✚ **Drought Resistance:** Due to India's tropical climate, water scarcity, especially during drought seasons greatly affects its agricultural productivity. **Nano Fertilizers can play** a vital role in such cases by increasing the water retention capacity of the crops, making them more resilient during dry spells.
- ✚ **Enhanced Nutrients:** With traditional fertilizers, a significant portion of nutrients are lost due to leaching or volatilization. On the other hand, Nano Fertilizers encapsulate nutrients and protect them from being destroyed. This leads to improved nutrient absorption by plants, maximizing their growth potential and goes hand in hand with increased crop yields.
- ✚ **Nano Pesticides Synergy:** One of the major advantages of Nano fertilizers is that they can be tailored to release nutrients and pesticides simultaneously. This has led to the development of “smart fertilizers” that not only nourish plants but also protect them from pests and diseases.
- ✚ Overall, the development of Nano Fertilizers has led to a significant leap towards sustainable agriculture in India with its ability to enhance nutrient efficiency and promote environment-friendly. As this revolutionary technology continues to evolve, its potential to address food security challenges and elevate India's agricultural sector becomes even more promising.



Results of Nano DAP on Wheat Crop is excellent increase germination and uniformity in germination. Two Demonstration Results of Nano DAP shown in pictures in Wheat Field with Seed Treatment (5ml/kg)

Name - Jagjit Singh (9815080116)	Name - Joginder Singh (9478762425)
Village - Powat	Village - Powat
Crop - Wheat Seed Rate - 42 kg/ acre	Crop - Wheat Seed Rate - 40 kg/ acre
Previous Crop - Paddy	Previous Crop - Potato
Date of Sowing - 20/11/2023	Date of Sowing - 20/11/2023
Variety - DBW 187 and DBW 222 Area - 1 acre	Variety - DBW 187 and DBW 222 Area - 1.5 acre
Granular DAP dose decreases 70 kg/acre to 40 kg/acre	No use of Granular DAP because previous crop is Potato.
	Location - Machiwara Sahib
	HQ - Khanna
	SFA - Amrinder Singh



Result of Nano DAP on Wheat Crop with Seed Treatment (5ml/Kg)



Seed Treatment with Nano DAP of Wheat Crop in Punjab and reduce 50% Granular DAP

Below are the general instructions

- Shake the bottle well before use
- Use flat fan or cut nozzles for uniform spraying on the foliage.
- Spray during morning or evening hours avoiding dew.
- It is advised to repeat the spray, if rain occurs within 12 hours of Nano DAP spray.
- Nano DAP (Liquid) can be mixed easily with most of the bio stimulants, other nano fertilisers like Nano Urea, 100% Water Soluble Fertiliser's and agrochemicals; but it is advised to go for 'Jar test' before spraying
- For better result Nano DAP should be used within 2 years from the date of its manufacturing.

Benefits of Nano DAP

- ✚ **Higher Crop Yield:** Due to small size and more surface area to volume ratio; seed treatment and foliar application of Nano DAP at critical growth stages enhances nutrient availability to crops. Hence, Crop yield increases due to increase in leaf chlorophyll, photosynthesis, root biomass, number of effective tillers and branches.
- ✚ **Increase in Farmer's Income:** IFFCO Nano DAP increases farmers' income due to reduction in input cost, higher crop yield and better quality of crop produce.
- ✚ **Quality Food:** Nutritional quality of harvested food produce was found to be better in terms of protein and nutrient content.
- ✚ **Reduction in Chemical Fertilizer Usage:** Enhanced use efficiency of one bottle (500 ml) of Nano DAP can potentially replace the phosphorus requirement met by conventional DAP by 50%. Since Nano DAP helps in meeting the nitrogen and phosphorus requirement at critical growth stages leading to judicious application of bulk chemical fertilizer
- ✚ **Environment Friendly:** Production of Nano DAP is energy and resource friendly. The field application of Nano DAP reduces excessive application of bulk fertilizers like DAP and reduction in associated volatilization, leaching and run off losses. Precision and targeted application of Nano DAP to crops therefore leads to agriculture sustainability and safety of the environment by reducing soil, air and water pollution.
- ✚ **Easy to Store & Transport:** Nano DAP is required in small quantity Vis a Vis bulky phosphatic fertilizers like DAP. This has significant impact on logistics and warehousing



of the fertilizers. Farmers can physically carry bottles of Nano DAP easily in comparison to bulky phosphatic fertilizers

