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A study on perception of farmers towards nano dap in Nalgonda district of Telangana

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Abstract

Conventional fertilizers have been crucial in boosting agricultural productivity, greatly enhancing global food security. However, these conventional fertilizers have their own set of disadvantages. Issues such as heavy dependence on imports for both manufactured products & raw materials, fiscal burden of fertilizer subsidy on economy, adverse effects of imbalanced use of fertilizers, Moreover, the inefficiency in nutrient use often results in wastage and pollution. Nano fertilizers are emerging as a promising solution to address the above challenges. By utilizing nanoscale materials, these advanced fertilizers enhance the precision and efficiency of nutrient delivery to plants. Nano DAP addresses the critical requirement of phosphorus in the chlorophyll for facilitating photosynthetic activity. Nano DAP consists of particles of polymer encapsulated DAP which are of nano size (<100 nm). This study investigates farmers perceptions towards Nano DAP in the Nalgonda district of Telangana. A sample of 120 farmers were surveyed by purposive sampling method.

Keywords: Nano DAP, perception, usage patterns, nano fertilizers, Nalgonda

Introduction

The use of conventional fertilizers has significantly increased agricultural output and improved global food security. Their capacity to provide essential minerals like nitrogen, phosphate, and potassium has allowed farmers to achieve extraordinary crop yields. These conventional fertilizers do have certain drawbacks. Problems include an excessive reliance on imports for both manufactured goods and raw materials, the financial strain of fertilizer subsidies on the economy, the negative impacts of uneven fertilizer application, and the fact that inefficient nutrient use frequently leads to waste and pollution.

India's fertilizer production has increased but still falls short, with 30% of demand met through imports. In 2022-2023, deficits for phosphate (P_2O_5) and nitrogen (N) were 2.91 million MT and 4.47 million MT, respectively, while all potash (K_2O) needs were imported. Imports included 5.17 million MT of N, 3.66 million MT of P_2O_5, and 1.43 million MT of K_2O, with significant increases in DAP and NP/NPK complex imports, but declines in MOP and urea imports. India relies heavily on imports, with 50% of phosphate from imported rock phosphate and 100% of potassium fertilizers imported.

Fertilizer use surged after the Green Revolution, driven by subsidies, which grew from ₹ 60 crores in 1976-77 to ₹1.64 lakh crores in 2024-25. However, these subsidies have been criticized for benefiting manufacturers more than farmers and contributing to soil nutrient imbalances, environmental issues, and health hazards. The Government introduced a Direct Benefit Transfer (DBT) system in 2016 to address these issues.

Low Nutrient Use Efficiency (NUE) in conventional fertilizers has led to wastage and environmental pollution. NUE is low for potassium (18-20%), phosphorus (35-40%), and nitrogen (30-35%). To address inefficiencies, interest in nano fertilizers is growing, as they promise to enhance nutrient delivery, improve soil health, and reduce environmental impacts.

Nano fertilizers

Nano fertilizers are nutrients coated or encapsulated in nanomaterials (1-100 nano meters) to allow for controlled release and gradual soil diffusion, enhancing nutrient absorption in plants. These fertilizers deliver nutrients more efficiently and sustainably by providing a consistent supply over time, reducing the overall amount needed and frequency of applications. Nanomaterials, with their high surface area-to-volume ratio, are ideal for nutrient retention and release.

While natural nanoparticles exist in biological materials and sources like volcanic ash, large-scale synthesis requires advanced nanotechnology. In agriculture, nano fertilizers boost crop yields, reduce losses, and strengthen plant defence against pests and environmental challenges. They also reduce runoff and nutrient leaching, increasing environmental sustainability and lowering costs. Nano fertilizers offer a promising, efficient, and economical solution for improving agricultural sustainability and meeting the global demand for food.

Nano DAP

Nano DAP is a new liquid fertilizer announced by the Indian government on March 2, 2023, under the FCO (1985). Developed in India, it is an unsubsidized fertilizer with a nutrient use efficiency exceeding 90% in ideal conditions. Nano DAP consists of nanoscale polymer-encapsulated DAP particles (less than 100 nm), which, when diluted and sprayed on plant leaves, are absorbed through stomata and cuticular pores. These particles gradually release phosphorus, essential for photosynthesis, ensuring sufficient chlorophyll concentration.

IFFCO Nano DAP, containing 8.0% nitrogen (N) and 16.0% phosphorus (P_2O_5), addresses nitrogen and phosphorus deficits in crops. Its nano-sized particles enhance seed vigour, chlorophyll levels, photosynthetic efficiency, and overall crop quality and yield. Additionally, Nano DAP's precise, targeted application reduces environmental impact while effectively nourishing crops.

Materials and Methods

Nalgonda district of Telangana was taken up as study area. The primary data regarding usage pattern & perception of Nano DAP was collected from 120 respondent farmers, who used Nano DAP in their fields, The purposive sampling method has been used to select the sample. Secondary data regarding the cropping area of mandals, villages will be collected from official records maintained at mandal revenue office, The tools used for analysis of data is percentage analysis, chi-square test and likert scale.

Results and Discussion

Demographic characters of farmers

The data with regard to the demographic characteristics which encompass gender, age, education level, amount of land cultivated, and crop production patterns, was collected from sample farmers.

Table 1: Demographic characters of farmers

(n=120)

S. No	Particulars	Number of respondents	Percentage
1	**Gender**		
	Male	120	100
2	**Age**		
	20-30	16	13
	30-40	47	39
	40-50	38	32
	50-60	12	10
	>60	7	6
3	**Education status**	44	37
	Primary school	49	32
	Secondary school Higher	30	25
	secondary school Graduate	7	6
4	**Farm size**		
	<2.5 acres	30	28
	2.5 -5 acres	25	38
	5-10 acres	45	21
	10-20 acres	16	10
	>20 acres	4	3
5	**Crop cultivation pattern**		
	Paddy	89	74.1
	Cotton	76	35
	Chilli	54	33.3
	Sweet lime	42	20.8
	Vegetables	23	10.8
	Jowar	2	1.6
	Pam oil	3	2.5

Usage pattern of Nano DAP by sample farmers

Analysing the usage patterns-how, when, and where Nano DAP is applied by the respondent farmers provides critical insights into optimizing its effectiveness, ensuring that crops receive the precise nutrients they need at the right time. This understanding also helps in mitigating environmental impacts, such as nutrient runoff and soil degradation, by promoting more sustainable farming practices.

Application method of Nano DAP adopted by sample farmers

The Nano DAP can be sprayed at different stages of crops by foliar spray and seed treatment can be done to seeds. For pulses, oilseeds, vegetables and cotton first spray is recommended at branching stage, and second spray at pre-flowering stage. For cereals and sugarcane first spray is recommended at tillering stage and second spray at late tillering stage is recommended. To know the farmers usage of different application methods data was collected from respondent farmers and the same is presented in table 2

Table 2: Application method of Nano DAP adopted by Sample farmers

(n=120)

S. No	Application method	Number of respondents	Percentage of respondents (%)
1	Foliar spray		
	1st spray	12	10
	2nd spray	120	100
	Only 2nd spray	108	90
2	Seed/root/sett/tuber treatment	12	10
3	Both	12	10

The foliar spray method is the dominant application method, being used by all respondents. with 90 percent of the farmers using it as a 50 percent replacement for the conventional fertilizers. This suggests it is highly favoured,

possibly due to its effectiveness, ease of use, or other benefits. A minority of respondents (10 percent) use alternative or additional methods such as seed/root/sett/tuber treatment, in combination with foliar spray to completely derive the benefits of Nano DAP.

Dosage and Volume of usage of Nano DAP per acre by respondent farmers as given by firm is:

The recommended dosage of Nano DAP for various application methods are

- Seed Treatment - 3-5 ml per Kg of seeds
- Root / Tuber / Sett Treatment - 3-5 ml per litre of water
- Foliar Spray - 2-4 ml per litre of water
- Volume of usage is 1 bottle per acre

The recommendations for usage of Nano DAP are either followed or not by sample farmers is presented in table 3

Table 3: Dosage and volume of usage of Nano DAP per acre

(n=120)

S. No	Recommendations of dosage and volume followed by sample farmers	Number of respondents	Percentage of respondents (%)
1	Yes	120	100
2	No	0	0

All 120 farmers (100 percent) in the sample reported following the recommended dosage and volume. This indicates complete compliance with the prescribed guidelines among the surveyed farmers, suggesting a high level of agreement with the recommended practices.

Association between usage pattern and crops

Understanding the association between Nano DAP usage patterns and specific crops is crucial for optimizing fertilizer application, improving crop yields, and ensuring efficient resource utilization. It helps tailor fertilization strategies to the unique nutrient requirements of different crops, leading to more sustainable and productive farming practices.
The usage pattern of Nano DAP varies based on crops

H0: The null hypothesis states that Usage pattern of Nano DAP does not varies significantly based on crop

H1: The alternate hypothesis states that usage pattern of Nano DAP varies significantly based on crop.

Usage pattern and crops cross-tabulation

The chi-square value from the data is 16.47 and P value is 0.011. Since the p-value is less than the common significance level of 0.05, we can reject the null hypothesis, suggesting that the usage pattern of Nano DAP varies significantly based on crop.

Association between usage pattern of Nano DAP and land holding size

The association between Nano DAP usage patterns and landholding size helps to understand how different farm sizes influence the adoption of innovative inputs. Larger farms may have more resources to experiment with new technologies, while smaller farms might rely on proven methods. This insight can guide tailored agricultural recommendations and policies.
The usage pattern of Nano DAP varies based on land holding size of farmers

H0: The null hypothesis states that Usage pattern of Nano DAP does not varies significantly based on land holding size of farmers.

H1: The alternate hypothesis states that usage pattern of Nano DAP varies significantly based on and holding size of farmers.

Usage pattern and land holding size of farmers cross - tabulation

The chi-square value from the data is 12.71 and P value is 0.013. Since p-value is less than common significance level 0.05, we can reject null hypothesis, and conclude that the usage pattern of Nano DAP varies significantly based on the landholding size of farmers.

Farmer's perception with regard to Nano DAP

The perception of farmers with regard to various aspects of Nano DAP has been gathered, the responses of farmers reflects their perception with regard to Nano DAP, Since the sample consists of farmers who used IFFCO Nano DAP.

Farmers perception about the features of Nano DAP

Farmers were asked to give their opinion about various features of Nano DAP. This information will help in knowing which product features farmers have liked the most and also help in identifying those features with which, the farmers are not highly satisfied which will help the firm to concentrate on improving those features. Farmers are asked to rate the features where 5= Highly satisfied, 4 = satisfied, 3 = Neutral, 2 = Dissatisfied, 1= Highly Dissatisfied.

Table 4: Farmers perception about the features of Nano DAP

(n=120)

S. No.	Perception about features of IFFCO Nano DAP	5	4	3	2	1
1	Product information	25	31.7	35.8	4.1	3.4
2	Packaging	8.3	22.5	65	1.7	2.5
3	Efficiency of the product	12.6	16.6	50	10	10.8
4	Application methods	16.6	22.5	50	5	5.9
5	Cost reduction	16.6	37.5	33.3	6.8	5.8
6	Product performance	12.5	25	50	8.4	4.1
7	Eco friendly nature	23.3	30.8	37.5	3.3	5
8	Overall satisfaction	4.1	16.8	66.6	7.5	5

The farmers' perception of Nano DAP varies across different features. The highest satisfaction is noted in product information (25% highly satisfied) and its eco-friendly nature (23.3% highly satisfied). However, overall satisfaction is low, with 66.6% remaining neutral and only 4.1% highly satisfied. Packaging and application methods have a majority of neutral responses (65% and 50%, respectively). Efficiency and cost reduction show mixed satisfaction, with significant portions being neutral or dissatisfied. This indicates that while some aspects are appreciated, overall, farmers are ambivalent or uncertain about the product's benefits.

Farmers source for information about recommended doses of Nano DAP

The study aimed to identify the main sources from which farmers acquire dosage guidelines for their agricultural practices with regard to Nano DAP. The information about farmers acquiring knowledge about recommendation of doses from various sources is presented in table 5

Table 5: Farmers source for information about recommended doses of Nano DAP

(n=120)

S. No.	Source for dosage guidelines	No. of respondents	Percentage (%)
1.	Agriculture officers	4	3.3
2.	State Agricultural University/KVK	0	0
3.	Fellow progressive farmer	45	37.5
4.	Experience of using Nano urea	34	28.3
5.	Dealers	92	76.6
6.	Field officers of the firm	68	56.6
7.	Social media (facebook/ whatsapp/ youtube)	29	24.1
8.	TV and newspapers advertisement	6	5

The primary source of information for recommended doses of Nano DAP among farmers is dealers, with 76.6% of respondents relying on them. Field officers of the firm are also a significant source, consulted by 56.6% of the farmers. Fellow progressive farmers (37.5%) and personal experience with Nano urea (28.3%) are other notable sources. Social media is used by 24.1%, while traditional sources like agricultural officers and TV/newspaper advertisements are less influential, with only 3.3% and 5% reliance, respectively. State Agricultural Universities/KVKs are not consulted at all, indicating a preference for more immediate, practical sources of information.

Willingness to repurchase Nano DAP for the next season

The willingness to repurchase Nano DAP serves as a crucial indicator of the product's acceptance and perceived value among farmers. The data on willingness to repurchase Nano DAP among farmers is presented in table 6

Table 6: Willingness to repurchase Nano DAP for the next season

(n=120)

S. No.	Willingness to repurchase Nano DAP for the next season	No. of respondents	Percentage of respondents (%)
1.	Yes	105	87.5
2.	No	15	12.5

The vast majority of farmers (87.5%) are willing to repurchase Nano DAP for the next season, indicating overall satisfaction or trust in the product despite some concerns. Only 12.5% are unwilling to repurchase, suggesting a relatively small group of dissatisfied users.

Reasons for not willing to repurchase Nano DAP

The main reason for farmers not repurchasing Nano DAP is the lack of noticeable improvement in yield, indicating that the product has not met their expectations. Additionally, some farmers haven't observed visible benefits, and there is resistance to shifting from conventional fertilizers. Concerns about the sufficiency of the recommended dosage and doubts about long-term benefits also contribute to their reluctance, reflecting uncertainty and skepticism regarding the product's effectiveness.

Challenges faced by farmers while using Nano DAP

Understanding the challenges is crucial for stakeholders to address farmer's apprehensions and enhance the acceptance and success of Nano DAP in the agricultural sector. Farmers were asked to rate the identified challenges.

The primary challenge farmers face with Nano DAP is the need for reapplication if it rains within 24 hours, which can be inconvenient and costly. The product's slower performance compared to traditional fertilizers is also a significant concern. Additionally, farmers are frustrated by the increased cultivation costs due to dealers and field officers pushing other products alongside Nano DAP. Lastly, difficulties in application and confusion about proper dosage, especially for orchard crops, further hinder its adoption.

Intention to recommend Nano DAP to other farmers

The intention to recommend a product like Nano DAP among farmers is a powerful indicator of its perceived value and effectiveness. The intention to recommend Nano DAP to other farmers by the respondent farmers is presented in table 7

Table 7: Intention to recommend Nano DAP to other farmers

(n=120)

S. No.	Intention to recommend Nano DAP	No. of respondents	Percentage (%)
1.	Yes	105	87.5
2.	No	15	12.5

A large majority of farmers (87.5%) are willing to recommend Nano DAP to others, indicating a positive overall perception and confidence in the product despite some challenges. Only 12.5% would not recommend it, reflecting a minority who may have had less satisfactory experiences or concerns about its effectiveness. This suggests that Nano DAP has generally been well-received among the farming community.

Conclusion

The study reveals that Nano DAP is widely adopted among farmers, with foliar spray being the preferred application method and complete compliance with recommended dosages. While most farmers express satisfaction with certain aspects, such as product information and eco-friendliness, overall satisfaction remains neutral. Dealers and field officers are the primary sources of dosage information. A significant majority of farmers are willing to repurchase and recommend Nano DAP, indicating overall trust in the product despite concerns about its effectiveness, cost, and application challenges. These insights suggest a generally positive reception but highlight areas for improvement to enhance farmer satisfaction.

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