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Extent of adoption of liquid micro grade by cotton growers

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Abstract

Micronutrients are essential elements required for plant growth, albeit in relatively small quantities, which is why they are termed "micro" nutrients. Despite their minimal concentration in plant tissues, they play a critical role in enzymatic activities, metabolic processes, and overall plant development. Cotton, a key commercial crop in Vidarbha, faces yield stagnation partly due to micronutrient deficiencies. This study investigates the extent of adoption of PDKV Liquid Micro Grade among cotton growers in Akola district, Maharashtra. Through an exploratory research design involving 120 purposively selected farmers across seven talukas, the study analyzed knowledge, constraints, and correlates of adoption. Results revealed that (95.00%) of respondents had moderate to high knowledge towards PDKV Liquid Micro Grades. The majority (53.33%) of the respondents exhibited a medium level of adoption of PDKV Liquid Micro Grades among cotton growers. This was followed by (41.67%) of respondents who demonstrated a high level of adoption, while only (05.00%) reported a low level of adoption regarding the use and perceived usefulness of PDKV Liquid Micro Grades. However, marketing gaps and compatibility issues with pesticides limited its full adoption. Education, economic motivation, and scientific orientation significantly influenced adoption. The findings underline the need for targeted extension and market strategies.

Keywords: Knowledge, adoption, liquid micro grade, micronutrient, cotton

Introduction

Agriculture is the backbone of human civilization, providing food, fiber, and raw materials for various industries. It is not just an occupation but a way of life for millions of farmers worldwide, especially in agrarian economies like India. Agriculture encompasses a wide range of activities, including crop cultivation, livestock farming, agroforestry, fisheries, and agribusiness. Soil is the primary source of essential nutrients required for plant growth and development. It provides a medium for root anchorage, supplies water, and stores nutrients vital for plant metabolism. The availability of these nutrients directly affects crop yield, quality, and overall plant health.

Essential components needed in trace levels for plant growth and development are micronutrients. Deficits in essential nutrients contribute to the yield stagnation of cotton, a significant commercial crop in Vidarbha. Micronutrients are necessary for important enzymatic processes, metabolic pathways, and the general physiological well-being of plants, while being found in trace amounts in plant tissues. The primary micronutrients necessary for plant growth include Boron (B), Chlorine (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), and Zinc (Zn). Maharashtra, represents a significant advancement in enhancing crop productivity and addressing nutrient deficiencies specific to cotton cultivation.

PDKV Liquid Micro grade is a specialized micronutrient fertilizer developed or recommended by Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), tailored to address micronutrient deficiencies commonly observed in crops like cotton. Cotton, often referred to as "white gold," is one of the most important fiber and cash crops in India, playing a crucial role in both the industrial and agricultural economy of the country. Vidarbha, one of the largest cotton-growing regions in India, contributes 30% of Maharashtra's total cotton production. However, soil nutrient deficiencies pose a significant challenge to agricultural productivity in this region. Despite its proven benefits, adoption varies,

prompting this study to explore its uptake among cotton growers. To address the specific micronutrient needs of different crops, the Department of Soil Science at Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola, has developed three distinct crop-specific Liquid Micro Grades. PDKV Liquid Micro Grade II is recommended for vegetables, cereals, pulses, and fruit crops, and it contains Iron (25%), Zinc (2%), Boron (0.5%), Manganese (1%), Copper (1%), and Molybdenum (0.1%). PDKV Liquid Micro Grade X is specially formulated for pulses, with a composition of Iron (2.5%), Zinc (5%), Boron (0.5%), and Molybdenum (0.1%). For cotton cultivation, PDKV Liquid Micro Grade XI has been developed, which includes Iron (2.5%), Zinc (5%), and Boron (0.5%). These formulations aim to improve nutrient management by providing essential micronutrients in appropriate proportions, thereby enhancing crop productivity and soil health.

Objectives

1. To study the profile of cotton growers
2. To assess the adoption of PDKV Liquid Micro Grade
3. To determine the relationship between profile characteristics and adoption
4. To identify the constraints in adoption

Methodology

The study entitled "Adoption of PDKV Liquid Micro Grade by cotton growers" was conducted in Akola district in Vidarbha region of Maharashtra state all seven tehsil were selected purposively. For this study, all seven talukas were deliberately chosen based on the criterion that they had the highest number of cotton farmers utilizing PDKV Liquid Micro Grades.

The study adopted an exploratory research design to investigate the adoption behavior and associated factors related to the use of PDKV Liquid Micro Grade among cotton growers.

From the selected talukas, only those farmers who had been using PDKV Liquid Micro Grades for the past three years were considered as beneficiaries. Among these beneficiaries, a total of 120 farmers were selected. The list of beneficiaries, along with their names and addresses, was collected from the Department of Soil Science and the Agricultural Technology Information Centre (ATIC), Dr. Panjabrao Deshmukh Krishi Vidyapeeth. Thus, the study included a total of 120 beneficiary farmers for data collection and analysis.

Results and Discussion

Personal and socio-economic characteristics

The characteristics namely age, education, land holdings, annual income, area under cotton crop, farming experience, source of information, scientific orientation, economic motivation, knowledge were the variables studied under personal characteristics. The findings pertaining to distribution of the respondents on these characteristics are presented in the following table.

The present study included 120 respondents categorized based on various independent variables. Regarding age, the majority (45.00%) of the respondents were from the middle age group (36 to 50 years), followed by 29.17 per cent from the old age group (51 years and above), while 25.83 per cent belonged to the young age group (up to 35 years). In terms of educational qualification, none of the respondents were illiterate. A significant proportion (47.50%) had completed college-level education, followed by 27.50 per cent who had studied up to higher secondary school, and 20.00 per cent had completed secondary school. A very small portion had only primary (01.67%) or middle school education (3.33%).

With respect to land holding, a major share (37.50%) of the respondents fell under the medium category (4.01 to 10.00 ha), followed by 20.83 per cent who owned large landholdings (above 10.00 ha). Semi-medium and small farmers accounted for 19.17 per cent and 14.17 per cent, respectively, while marginal farmers (up to 1 ha) constituted only 8.33 per cent. In terms of annual income, the highest proportion (30.84%) earned between Rs. 7,50,001 to Rs. 10,00,000 annually, followed by 24.16 per cent earning above Rs.10,00,001. Meanwhile, 16.67 per cent had an income of Rs. 2,50,001 to Rs. 5,00,000, and 12.5 per cent earned up to Rs. 2,50,000.

Considering the area under cotton cultivation, most of the respondents (40.00%) cultivated cotton on 2 to 4 hectares of land, followed closely by 38.30 per cent with up to 2 hectares, and 21.70 per cent had more than 4 hectares under cotton. In terms of farming experience, a large majority (67.50%) fell into the medium experience category (12 to 33 years), followed by 19.17 per cent with low experience (up to 11 years) and 13.33 per cent with high experience (above 34 years).

Regarding sources of information, 57.50 per cent of the respondents had medium-level access to information sources, while 25.00 per cent had high access and 17.50 per cent had low access. For scientific orientation, 55.00 per cent of the respondents had medium orientation, 26.67 per cent had high, and 18.33 per cent had low scientific orientation. Economic motivation was medium for the majority (53.33%), high for 35.00 per cent, and low for 11.67 per cent of the respondents.

In terms of knowledge about the subject matter, 50.83 per cent of the respondents were in the medium knowledge 45.00 per cent had high knowledge and only 04.17 per cent were in the low knowledge.

Table 1: Distribution of respondents according Personal and socio-economic Characteristics.

Sr. No.	Independent Variable	Frequency (n=120)	Percentage (100%)
1)	**Age (Year)**		
i.	Young (Up to 35)	31	25.83
ii.	Middle (36 to 50)	54	45.00
iii.	Old (51 and above)	35	29.17
2)	**Education**		
i.	Illiterate	00	00.00
ii.	Primary school (Up to 4th)	02	01.67
iii.	Middle school (5-7th)	04	03.33
iv.	Secondary school (8-10th)	24	20.00
v.	Higher secondary school (11-12th)	33	27.50
vi.	College (above 12th)	57	47.50
3)	**Land Holding**		
i.	Marginal (Up to 1.00 ha)	10	08.33
ii.	Small (1.01 to 2.00 ha)	17	14.17
iii.	Semi-medium (2.01 to 4.00 ha)	23	19.17
iv.	Medium (4.01 to 10.00 ha)	45	37.50
v.	Large (Above 10.01 ha)	25	20.83
4)	**Annual Income**		
i.	Up to Rs. 2,50,000/-	15	12.50
ii.	Rs. 2,50,001 to 5,00,000/-	20	16.67
iii.	Rs. 5,00,001 to 7,50,000/-	19	15.83
iv.	Rs. 7,50,001 to 10,00,000/-	37	30.84
v.	Above Rs. 10,00,001/-	29	24.16
5)	**Area Under Cotton Crop**		
i.	Up to 2 ha	46	38.30
ii.	2 ha to 4 ha	48	40.00
iii.	Above 4 ha	26	21.70
6)	**Farming Experience**		
i.	Low (Up to 11 Years)	23	19.17
ii.	Medium (12 to 33 Years)	81	67.50
iii.	High (Above 34 Years)	16	13.33
7)	**Sources of Information**		
i.	Low (Up to 18.45)	21	17.50
ii.	Medium (18.46 to 22.45)	69	57.50
iii.	High (Above 22.46)	30	25.00
8)	**Scientific Orientation**		
i.	Low (Up to 21.99)	22	18.33
ii.	Medium (22.00 to 26.41)	66	55.00
iii.	High (Above 26.42)	32	26.67
9)	**Economic motivation**		
i.	Low (Up to 22.90)	14	11.67
ii.	Medium (22.91 to 25.24)	64	53.33
iii.	High (Above 25.25)	42	35.00
10)	**Knowledge**		
i.	Low (73.33 to 82.22)	05	04.17
ii.	Medium (82.22 to 91.11)	61	50.83
iii.	High (91.11 to 100)	54	45.00

Adoption of PDKV Liquid Micro Grade by cotton growers

The extent of adoption of specific practices related to PDKV Liquid Micro Grade was assessed under three categories - Complete Adoption (CA), Partial Adoption (PA), and Non-Adoption (NA).

Table 2: Distribution of respondents according to practice wise adoption about PDKV Liquid Micro Grade

Sr. No.	Statements	Adoption		
		CA	PA	NA
1.	Soil testing is conducted before deciding on PDKV liquid micro grade application.	56 (46.67)	49 (40.83)	15 (12.50)
2.	Application of PDKV liquid micro grades are carried out as per recommendation	87 (72.50)	19 (15.83)	14 (11.67)
3.	Different grades of PDKV Liquid Micro Grade are identified and selected as per crop requirements.	82 (68.30)	17 (14.17)	21 (17.50)
4.	PDKV Liquid Micro Grade XI is specifically used in the cultivation of cotton.	120 (100.00)	00	00
5.	Foliar spray method is adopted for applying PDKV Liquid Micro Grades.	118 (98.30)	02 (01.70)	00
6.	Spraying is carried out before 11 AM or after 4 PM.	82 (68.30)	26 (21.70)	12 (10.00)
7.	50 ml is applied at branching stage and 100 ml per 10 liters of water at flowering stage	104 (86.70)	11 (09.17)	05 (04.17)
8.	PDKV Liquid Micro Grades are not mixed with insecticides or fungicides during application.	120 (100.00)	00	00
9.	Observes a waiting period of 4-5 days after spraying the PDKV liquid micro grade.	86 (71.70)	23 (19.17)	11 (09.17)
10.	PDKV Liquid Micro Grade is thoroughly mixed with water before application.	114 (95.00)	06 (05.00)	00
11.	Knapsack sprayer is used for spraying PDKV Liquid Micro Grade.	116 (96.70)	04 (03.33)	00
12.	Quantity of PDKV liquid micro grade is doubled when applying with a power sprayer.	112 (93.30)	08 (06.70)	00

The data presented in the table 2, which shows the practice-wise adoption of PDKV Liquid Micro Grade by cotton growers reveals insightful trends. About (46.67%) of respondents completely adopted the practice of conducting soil testing before PDKV Liquid Micro Grade application, while (40.83%) partially adopted it, and (12.50%) did not follow it at all. Regarding the application of Liquid Micro Grade as per recommendation, a majority (72.50%) reported complete adoption, (15.83%) partial adoption, and (11.67%) non-adoption. In terms of identifying and selecting appropriate grades of PDKV Liquid Micro Grade according to crop requirements, (68.30%) fully adopted the practice, while (14.17%) did so partially, and (17.50%) did not adopt it. Notably, all respondents (100.00%) reported using PDKV Liquid Micro Grade XI specifically for cotton, indicating complete adoption of this practice.

The foliar spray method for application was widely accepted, with (98.30%) of respondents fully adopting it and only (01.70%) partially adopting. Regarding the time of spraying before 11 AM or after 4 PM (68.30%) adhered completely, (21.70%) partially, and (10.00%) did not follow the recommended timing. As for the recommended dosage, (86.70%) of respondents applied 50 ml at the branching stage and 100 ml per 10 liters of water at the flowering stage, with (09.17%) following it partially and (04.17%) not adopting it. The practice of not mixing PDKV Liquid Micro Grade with insecticides or fungicides during application was fully adopted by all respondents (100.00%).

Observing a waiting period of 4 to 5 days post-application was completely followed by (71.70%), partially by (19.17%), and not followed by (09.17%). Thorough mixing of PDKV Liquid Micro Grade with water before application was adopted by (95.00%) of respondents, and (05.00%) followed it partially. The use of a knapsack sprayer for PDKV Liquid Micro Grade application was reported by (96.70%) of respondents, while (03.33%) used it partially. Finally, the practice of doubling the quantity of PDKV Liquid Micro Grade when using a power sprayer was fully adopted by (93.30%), with (06.70%) adopting it partially.

Table 3: Distribution of respondents according to their level of adoption of PDKV Liquid Micro Grade

Sr. No.	Adoption	Frequency (n=120)	Percentage
1.	Low (66.66 to 77.77)	06	05.00
2.	Medium (77.78 to 88.88)	64	53.33
3.	High (88.89 to 100)	50	41.67
	Total	120	100.00

As shown in table 3, the overall adoption level of PDKV Liquid Micro Grade among cotton growers revealed that a majority of the respondents (53.33%) fell under the medium adoption category, followed by (41.67%) who exhibited high adoption. Only (06.00%) of the farmers were categorized under the low adoption group. This indicates that more than (95.00%) of the respondents had medium to high levels of adoption, reflecting a generally positive response towards the use of PDKV Liquid Micro Grade among cotton growers in the study area.

Relationship of selected characteristics of respondents with adoption

Table 4: Coefficients of correlation between selected characteristics of respondents with adoption

Sr. No.	Variables	r' value
1.	Age	-0.3706^{NS}
2.	Education	0.5200**
3.	Land holding	0.2342*
4.	Annual income	0.2195*
5.	Area under Cotton crop	0.1719*
6.	Farming Experience	-0.3507^{NS}
7.	Source of information	0.26176*
8.	Scientific orientation	0.2539**
9.	Economic motivation	0.2011*
10.	Knowledge	0.28127**

*Significant at 0.05 level of probability **Significant at 0.01 level of probability NS - Non-significant

The correlation analysis, as presented in Table 4, revealed that variables such as education, scientific orientation, and knowledge showed a highly significant positive relationship with the adoption of PDKV Liquid Micro Grade. Additionally, land holding, annual income, area under cotton, source of information, and economic motivation also exhibited a significant positive correlation at the 0.05% level, indicating their influential role in adoption. In contrast, age and farming experience showed non-significant negative correlations, suggesting that older and more experienced farmers were comparatively less inclined towards adopting the technology. These findings highlight the importance of education, scientific outlook, and access to information in enhancing technology adoption among cotton growers.

Constraints in adoption of PDKV Liquid Micro Grade:

Despite the proven benefits of PDKV Liquid Micro Grade in enhancing crop productivity, its widespread adoption among farmers remains limited. Various socio-economic and technical challenges act as barriers, preventing effective utilization of the product. Identifying and understanding these constraints is crucial for improving adoption rates and refining extension strategies to promote its use at the grassroots level.

Table 5: Constraints in Adoption PDKV Liquid Micro Grade

Sr. No.	Constraint	%
1.	Lack of local marketing channels	81.67
2.	Incompatibility with insecticides/fungicides (requires separate spraying)	68.50
3.	Additional labor cost	63.00

Table 5 illustrates the distribution of respondents according to the constraints experienced during the use of PDKV Liquid Micro Grade. According to 81.67 percent of respondents, the biggest obstacle to PDKV Liquid Micro Grade adoption is the absence of local marketing channels, which came in top. The incompatibility of PDKV Liquid Micro Grade with fungicides and insecticides, which

required separate spraying according to 68.50 percent of respondents, and the additional labor costs related to separate spraying operations, which were ranked second and third by 63.00 percent of respondents, respectively, came next.

Conclusion

The findings of the study conclude that the majority of respondents demonstrated a medium level of adoption (53.33%) of PDKV Liquid Micro Grade. Variables such as education (47.50%), land holding (37.50%), annual income (30.84%), area under cotton (40.00%), information sources (57.50%), scientific orientation (55.00%), economic motivation (53.33%), knowledge (50.83%), showed significant positive correlations with adoption. However, demographic variable like age (45.00%) and farming experience (67.17%) had no significant influence. The key barriers identified were the unavailability of local marketing outlets, the need for separate spraying due to incompatibility with other agrochemicals, and the added labour cost for separate application procedures.

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