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Performance of Nauroji novel banana pseudostem based organic liquid nutrients (Fertilizer) on yield of mango and sapota

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Abstract
With the objective of raising awareness about the utilization of NAUROJI NOVEL Banana Pseudostem-based Organic Liquid Nutrients (Fertilizer) spray inmango variety "Kesar" and Sapota variety "Kalipatti,". A series of comprehensive demonstrations were executed throughout the 2020-21 time frame across multiple areas within the Navsari district, namely Navsari, Jalalpore, and Gandevi. The patented product spray led to enhanced yields in demonstrated plot (94.00 and 133.00 q/ha) in comparison to the control plots (85.00, 117.00 q/ha), this resulted in yield increments of 10.59and 13.68% for mango and sapota, respectively. The extension gap (9.00 and 16.00 q/ha), technology gap (11.00 and 17.00 q/ha), technology index (10.48 and 11.33 q/ha), along with a net return increase (15.13% and 18.03%), were documented for Mango and Sapota, respectively. Additionally, with an added cost of 7000 Rs/ha for both crops, there was an incremental return of 21,705 Rs/ha and 29,238 Rs/ha observed for Mango and Sapota crops, respectively.

Keywords: Novel, organic, liquid fertilizer, extension gap, mango and sapota yield

Introduction
Bharat holds the top position in the production of Banana (26.08%), Papaya (44.05%) and Mango (45.89%). Its contribution to global fruit production stands at 11 percent (Gurjar *et al*., 2023 a) [11]. The major mango producing nations are Bharat, China, Thailand, Indonesia, the Philippines, Pakistan, Brazil, Bangladesh, the USA, Africa and Mexico (Adikshita *et al*., 2018) [1]. To maintain this coveted top rank, consistent efforts are essential to enhance productivity. South Gujarat is renowned as a hub for horticultural crops. In the revered Sanskrit language, the mother of all languages, it is referred to as 'Amrafal,' while in Hindi, it is simply known as 'Aam.' Mango (*Mangifera indica* L.) and sapota [*Manilkara acharas* (Mill.)] are main fruit crops grown in Navsari district of Gujarat (Bhalekar and Chalak, 2016) [7]. Mango, is renowedas the King of Fruits, it is also 'National Fruit of Bharat.' Its delectable taste, vibrant appearance and richness hold unique significance in tropical regions. Similarly, sapota, a delightful fruit renowned for its role in milkshakes, contributes significantly to the local fame. It is an excellent fruit which gives reliable income to the farmer for 5 to 6 calendar month (Gurjar *et al*., 2022) [10]. Moreover, both these fruit-bearing trees yield positive impacts on the environment, ecology, economy and overall sustainability, thereby contributing to the well-being of farmers and all those involved in the production marketing and selling chain.
The limited use of well-rotten farmyard manure (FYM) and the excessive application of chemical fertilizers have reflected adverse consequences on the overall physical condition of the soil. This lead to, in the depreciation of soil's physical and chemical properties causing in stagnation in the yield of the crop and if the trend continues, it will have catastrophic outcomes (Hiwale*et al*, 2010) [13]. Sapota trees produce flowers intermittently during the year in various cycles. However, the issue arises when both flowers and fruits drop at critical stages, starting from their initial formation until they reach maturity. On the other hand, mango trees only experience a single flowering season per year. If flower or fruit drop occurs, it can result in a failed harvest for the entire year. The meteorological conditions play critical roles in the economic success or failure of crop.
The favourable conditions of medium black soil, warm climate, and moisture in Navsari district make it an ideal environment for cultivating these fruit crops (Gurjar *et al*., 2023 b) [12]. However, challenges such as fruit drop and flower drop hinder achieving higher productivity.

The formulation of NOVEL is a valuable source of plant nutrients, enriched with growth-promoting substances like cytokinin and gibberellic acid (Anonymous, 2014) [4]. To understand the impact of using NOVEL in practical farming, KVK Navsari organized demonstrations with the following objectives:

1. Assess the effect of NAUROJI NOVEL Banana Pseudostem-based Organic Liquid Nutrients (Fertilizer).
2. To evaluate the economic feasibility of the approach.
3. To Assess the resulting increase in productivity.

Materials and Methods

Krishi Vigyan Kendra (KVK) in Navsari demonstrated scientifically sound crop growing systems for major fruit crops. Specifically, focused on Mangovar. Kesar and Sapota var. Kalipatti during the Kharif season of 2020-21.Total 114 Front-Line Demonstrations (FLDs) covering 22.80 hectares for Mango and 125 FLDs over 25.00 hectares for the Sapota crop. These demonstrations were carried out in irrigated areas with good drainage facilities on the fields of farmers in Navsari, Jalalpore and Gandevi talukas (Blocks) within the Navsari district. The preference of the sites, farmers and the design of the demonstrations followed the recommendations put forth by Choudhary (1999) [8]. To gather a comprehensive list of farmers from various villages, surveys and farmer meetings were conducted. Before the FLDs, specific skill-based training sessions were taken. These sessions covered various aspects of scientifically proven cultivation practices and measures for plant protection. A notable component of these demonstrations was the utilization of NAUROJI NOVEL Banana Pseudostem-based Organic Liquid Nutrients (Fertilizer) spray, a patented product of N.A.U., Navsari, Gujarat. This fertilizer was applied twice in both the Mango and Sapota crops. For Mango, it was sprayed at a concentration of 2% during bud sprouting and flowering stages. In the case of Sapota, a 1% spray was applied in November, followed by another 30 days later after the first application. Farmers were also advised to follow recommended doses of fertilizers and manure, such as 750-160-750g and1000-500-500 grams NPK/plant/year in mango and in Sapota respectively, with 10 t/ha well-decomposed FYM in both crop. This approach aimed to ensure uniformity in the application of fertilizer and manure (Gurjar *et al*., 2022, 2023 a, 2023 b) [10, 11, 12].

In parallel, traditional practices were adhered to by local farmers as a comparison in what are referred to as "local checks." The benefit-cost ratio was determined based on collected data. Information regarding monetary returns and production costs were gathered from demonstration plots to assess the economic feasibility of cultivating Mango and Sapota crops using these practices. To measure the effectiveness of the demonstrations, the technology gap, extension gap and technology index were assessed, following the procedures suggested by Eswaraprasad *et al.* (1993) [9] and Samui *et al.* (2000) [15].

Results and Discussion

The use of NOVEL had a positive impact on Mango and Sapota yield. The Novel spray demonstration field plot recorded the highest yield (94.00 and 133.00 q/ha), which was notably higher than the yield in the check field plot (85.00 and 117 q/ha) for Mango and Sapota, respectively. These findings align with similar results seen in studies like Anonymous (2021) [6], which observed yield increases in Mango, Okra, Onion, Paddy, and Sapota, and Patel *et al*. (2018) [14] as well as Gurjar *et al.* (2022) [10], who reported increased yields in Mango and Sapota. Specifically, the yield increase was 10.59% for Mango and 13.68% for Sapota crops. Notably, the yield of the Mango demonstration plot (94.00 q/ha) displayed only a slight difference from the national average (96.64 q/ha) as seen in Table-1 of Anonymous (2018) [5]. However, this demonstration plot yield (94.00 q/ha) was higher than both the state average (74.20 q/ha) and the district average (91.92 q/ha). For Sapota, the demonstration plots yielded 133.00 q/ha, surpassing the national (121.24 q/ha), state (110.44 q/ha) and district average (126.90 q/ha). The improved yield in the demonstration plots could be ascribed to the existence of essential macro and micronutrients in NOVEL as well as farmyard manure. This finding supports the conclusions of Anonymous (2011; 2012; 2014) [2, 3, 4] and Gurjar *et al*. (2022) [10] in the studies on Mango and Sapota.

In the Navsari district, the potential yield for Mango var. Kesar was 105.00 q/ha, while for Sapota var. Kalipatti, it reached 150.00 q/ha. This calculation was based on trees that are 25 years old and spaced at a distance of 10 meters by 10 meters (Table 2).

Interestingly, there's an extension gap noticed in the yields. For Mango, the gap was 9.00 q/ha, and for Sapota crops, it was 16.00 q/ha. This discrepancy might stem from a lack of awareness about proper orchard management, the benefits of using organic manure and NOVEL. Farmers might not have been acquainted with the benefits of NOVEL and how it contributes to more sustainable crop yields. To address this, it becomes crucial to educate farmers about effective scientific cultivation methods. This can be achieved through meetings, training sessions, diagnostic visits and concept explanations.

Considering the technology gap, it was 11.00 q/ha for Mango and 17.00 q/ha for Sapota. This emphasizes the importance of educating farmers about adopting scientific production technology through various extension methods. Moreover, the technology index gives us an idea of the practicality of the demonstrations provided to farmers. In Mango, the index was 10.48%, while in Sapota, it stood at 11.33%. Interestingly, Sapota seems to offer more feasibility compared to Mango. These observations align with the findings of Gujjar *et al.* (2022) [10] in their studies on both Mango and Sapota.

The economic analysis (as shown in Table 3) provides valuable insights. In the NOVEL demonstrated plot of mango, the gross cost was 1,16,868 Rs/ha, while in the check plot, it stood at 1,11,573 Rs/ha. The increase in gross cost within the demonstration plot is due to the expenses related to using NOVEL spray and the associated application charges in the field. In the Mango demonstration plot the gross return and the net return (2,82,000 Rs/ha and 1,65,132 Rs/ha) was higher than the check plot (2,55,000 Rs/ha and 1,43,427 Rs/ha). Additionally, the BCR was higher at 2.41 compared to the check plot's 2.29. This improvement could be attributed to better nutrient application. Moreover, there was an additional cost of 7,000 Rs/ha for conducting this demonstration. However, this investment led to an extra return of 21,705 Rs/ha, resulting in a net return of 15.13%. These findings align with the conclusions drawn by Gurjar *et al*. (2022) [10] in their research on Mango.

The information regarding the Sapota fruit crop shows that in the demonstrated plot using NOVEL, the recorded gross cost was 1,07,883 Rs/ha. On the other hand, in the check plot, it

was lower at 1,01,121 Rs/ha. The increase in the gross cost within the demonstration plots can be attributed to the expenses related to conducting the demonstration and the associated charges for applying the product in the field. The gross return in the Sapota demonstration plot recorded a value of 2,99,250 Rs/ha. Meanwhile, in the check plot, this figure was 2,63,250 Rs/ha. As a result, the net return in the demonstration plot stood at 1,91,367 Rs/ha, while the check plot yielded 1,62,129 Rs/ha. The BCR, which helps assess the efficiency of the investment, was higher in the demonstration plot at 2.77, compared to the check plot's ratio of 2.60 for the Sapota fruit crop. This improved performance might be due to the enhanced absorption of nutrients from the soil, leading to better yield results. Considering the additional cost of 7,000 Rs/ha for conducting the demonstration, there was an extra return of 29,238 Rs/ha. This converted to a net return of 18.03%. It's worth noting that these findings are consistent with the conclusions drawn by Gurjar *et al.* (2022) [10] in their research on Sapota.

Table 1: FLDs organized, area and participation data during the year 2020-21.

	FLD organized			Area	Total	National average	State average yield	District average yield
Sr. No.	Crop	Variety	Season	(ha)	Participant	yield (q/ha)	(q/ha)	(q/ha)
1	Mango	Kesar	Kharif	22.80	114	96.64	74.20	91.92
2	Sapota	Kalipatti	Kharif	25.00	125	121.24	110.44	126.90

Table 2: Yield performances and calculations of FLDs organized during the year 2020-21

Sr. No.	Demonstration detail	Yield obtained (q/ha)		Yield increase (%)	Potential yield of the demo variety (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
	NAUROJI NOVEL Banana Pseudostem based Organic Liquid Nutrients (Fertilizer) Spray	Demo Average	Check Average					
1	Mango cv. Kesar	94.00	85.00	10.59	105.00	9.00	11.00	10.48
2	Sapota cv. Kalipatti	133.00	117.00	13.68	150.00	16.00	17.00	11.33

Table 3: Expenditure and Monetary return of FLDs organized during the year 2020-21

Sr. No.	Demonstration detail	Expenditure and Returns (Rs./ha)								Net Return increase percent	Additional	
	NAUROJI NOVEL Banana Pseudostem based Organic Liquid Nutrients (Fertilizer) Spray	Demo				Check					Cost (Rs/ha)	Return (Rs/ha)
		Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B: C ratio	Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B: C ratio			
1	Mango cv. Kesar	1,16,868	2,82,000	1,65,132	2.41	1,11,573	2,55,000	1,43,427	2.29	15.13	7,000	21,705
2	Sapota cv. Kalipatti	1,07,883	2,99,250	1,91,367	2.77	1,01,121	2,63,250	1,62,129	2.60	18.03	7,000	29,238

Conclusion

The findings of this study highlight that the incorporation of NAUROJI NOVEL Banana Pseudostem-based Organic Liquid Nutrients (Fertilizer) spray resulted in a significant increase of yield (10.59% and 13.68%) for Mango and Sapota fruit crops, respectively. Furthermore, the net return showed a notable rise, reaching 15.13% and 18.03% in the demonstration plot for Mango and Sapota crops, respectively. The technology gaps and extension gaps existed between the use of demonstration and farmer's practices. It can be easily observed from the data that by application of technical knowledge adopting recommended practices and by improvement of extension activities farmers can reach up to potential yield.

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