Market Potential and Buying Behaviour of Farmers Towards Biofertilizers in Western Maharashtra

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Abstract

Biofertilizers have a huge role to play in sustainable agriculture. They have beneficial impact on soil and are also cost effective. Despite having different potential activities, biofertilizers yet could not obtain popularity among farmers to accept it sufficiently. Despite the various advantages of biofertilizers in agricultural production, several limits at different levels, i.e. from the production unit to farmers' field, make it less popular in India. In this view, the present paper aims to study the market potential and the factors influencing the buying behaviours of farmers towards biofertilizers. The data was collected through structured questionnaires with 390 farmers and dealers in western Maharashtra. Further a focus group discussion with progressive farmers was conducted to present the best practices adopted by them. The study reveals that the price of the product and past experience has significant influence on the buying behaviour of farmers. The paper concludes by suggesting various approaches to increase the consumption of biofertilizers by farmers, and more significantly the role of progressive farmers as tool for awareness.

Keywords : *Biofertilizers, Buying Behaviour, Market Potential and Progressive Farmers.*

I. Introduction :

In India, Agriculture is an important sector of the Indian economy as it contributes about 17% to the total GDP and provides employment to over 60% of the population. Even though large hectares of area are under cultivation in this country, the yield per hectare for many crops is lower than the expected level. This is because of lack of adoption of new, improved practices, advanced techniques, use of non-productive soils, decreasing soil conditions, etc. It is possible to increase yield per unit area by adopting new production technologies viz., use of biofertilizers, vermicompost, organic farming, bio-control remedies, genetically modified crops, etc.

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The fertilizer sector is very crucial for the Indian economy because it provides very important input to agriculture. Moreover, the fertilizer industry, especially the ammonia urea plants, is highly energy-intensive in their operation. There are wide variations in the vintage of fertilizer plants in the country. In terms of feedstock, the major feedstock currently being used in the fertilizer plant are natural gas, naphtha and fuel oil / LSHS. Over the years, the majority of the industry has improved its performance significantly in terms of specific energy consumption and capacity utilization. There are several state-of-the-art fertilizer plants operating in India.

Biofertilizers contribute significantly to soil fertility improvement by fixing atmospheric nitrogen, both with and without the presence of plant roots, solubilizing insoluble soil phosphates, and creating plant growth chemicals in the soil. Thus, bio-fertilizers provide a safe method of improving land fertility through the use of biological wastes and helpful microbes that transmit organic nutrients to the field. Biofertilizers have emerged as promising environmentally acceptable inputs that can be used in conjunction with conventional fertilisers to ensure healthy plant growth. They have enormous promise for supplying plant nutrient requirements without relying on artificial fertilisers.

The widespread use of synthetic fertilisers has resulted in soil degradation and contamination, contaminating water basins, eliminating beneficial microbes and insects, making the crop more susceptible to disease, and reducing soil fertility. And the high expense of chemical fertilisers is putting small and marginal farmers out of business. The enormous quantity of foreign cash required to import synthetic fertilisers can be significantly lowered by switching to biofertilizers. Apart from the foregoing, long-term usage of bio-fertilizers is more cost effective, environmentally friendly, efficient, productive, and accessible to marginal and small farmers than chemical fertilisers (FEPSAN, 2010).

In this context, the paper aims to explore the ***Market Potential and Buying Behaviour Of Farmers in Western Maharashtra.***

The main objective of the present study is ;

- To assess the knowledge level and farmers' satisfaction towards Bio Fertilizers;
- To analyse the factors influence the buying behaviour of farmers towards the use of Bio Fertilizers;
- To document practices of progressive farmers to understand their adoption behaviour towards the usage of biofertilizers; and

- To suggest appropriate long-term and short-term practices and technologies based on the issues/constraints faced by the farmers towards the usage of bio fertilizers.

The paper is further organised as follows, Section II presents a literature review on market potential, farmersbuying behaviour and biofertilizers. Section III elaborated on adopted research methodology and proposed research questions, Section IV presents the results obtained from survey and focus group discussion Section V and VI discuss the findings and suggestions of the data and lastly Section VII outlines the conclusion.

II. Review of Literature:

A systematic literature study is presented below, which broadly focuses on market potential, farmers buying behaviour and the usage of Biofertilizers by potential farmers.

Soni and Singh (2013) in their research paper discussed about cooperative society for efficient distribution of fertilizer, to ensure that the right products are available to the farmer at right time and at the optimum price, consistent with the provision of a reliable service. Authors analysed key performance of Chattisgarh markfed. Markfed is now successfully handling and distributing agriculture fertilizer and pesticides. It was also found that shortage of funds, insufficient warehouses, lack of transport facilities, malpractices, untrained personnel, lack of coordination and supervision, poor management are some problem across efficient fertilizers marketing. The paper ends with effective suggestions to overcome these problems.

MK Jain, Vikas Garg, Sumit Agarwal (2017) carried out research on financial analysis of Indian farmer's fertilizer cooperative limited-IFFCO (A case study). In their study they stated that to gain opportunities in this area, a new IFFCO cooperative was created specifically to meet the needs of farmers. It was a unique business concept in which the farmers of the country through their own cooperative societies have created this new institution to defend their interests to make the farmer and his village self-sustainable. From the analysis of main Financial Indicators it is clear that Operating Profit to Turnover Ratio, Fixed Assets Turnover Ratio, Debt Equity Ratio, Current Ratio, Liquidity Ratio, etc are more than ideal position. However, company's Return on Capital Employed, Profit Before Tax to Turnover, etc were undesirable as compared to previous years.

D. M. Arvind Mallik and Qasim sab (2018) carried out a study on analysis of market potential for bio-fertilizers – an empirical study conducted

on behalf of Kalpatharu Bio-fertilizer-Shivamogga district. The study is based on primary data and it is collected from the customers through questionnaire. The result of the survey proves that the farmers are more prices conscious. To be dominant players in the market, sales promotion is very crucial weapon. According to the market research the farmers had given the positive response towards the Kalpatharubio-fertilizer. It shows that Kalpatharu biofertilizer is attracting the farmers. But in a competitive field one should not satisfy with one's present performance. In order to maintain higher competitive efficiency, regular market research will help an organization to ascertain the customer's preference and act according to them for creating and maintaining brand image in the minds of people.

Bhatt (2006) in his research article IFFCO in the Service of Farmers observed that IFFCO is playing major role to promote agriculture development and to make farmers aware of efficient and balanced use of fertilizer. Large number of program are being organised by the IFFCO to educate farmer like field programme, soil testing, farmer meeting, campaign, use of electronic and print media, training programmes for sale point personnel, etc. IFFCOs fertiliser marketing activities are spread in over 28 States and Union Territories of the country. Through various promotional and farmers educational programmes awareness among farmers are brought in by the IFFCO to adopt these technologies for enhancing crop productivity.

Mujahid (2011) revealed that majority of farmers used cow dung as organic fertilizer, while 64.34% and 80.00% farmers rely on their own production process to generate organic fertilizers and make decisions based on previous experience respectively. From this study they conclude that organic fertilizers are easily available as compared to the costly chemical fertilizer and farmers are prepared organic fertilizers on their own.

Kassie et al. (2009) studied Adoption of Organic Farming Technologies: Evidence from a Semi-Arid Region in Ethiopia and found that, a negative relationship between age and use of compost manure and stubble tillage in Ethiopia. Educated farmers were believed to have higher ability to perceive, interpret and respond to new information about improved technologies than their counterparts with little or no education.

Purohit, S.G., Dodiya, J.M.(2014) studied problems & issues in adoption of Biofertilizers in Agriculture by Farmers. The research study revealed that a majority of respondents i.e. 85% reported the lack of confidence towards various biofertilizers practices and methods. More than half of the respondents of the respondents i.e. 58% reported that lack of knowledge

about biofertilizers, followed by inadequate water availability i.e. 45% and lack of guidance from extension personnel are 41% of the total respondents. It is therefore, advisable that the extension agency should increase confidence level of farmers on usage of biofertilizers and also the method or practices to be used regarding biofertilizers. Information regarding utilization of biofertilizers can be shared through organizing training programmes, guest lectures, method and result demonstration and krishi mela, etc.

Raghvendra Pathak et.al (2016) made a study on knowledge and adoption behaviour of farmers farmers using biofertilizers in Ujjain district (Madhya Pradesh) and concluded that, more number respondents had adopted practices namely, type of bio fertilizer (33.33 per cent), quantity of biofertilizer used for one hectare (25.83per cent), time of application (34.16per cent), method of application (34.31per cent), yield increased by using biofertilizer (37.59 per cent) using biofertilizer before expiry date (32.50 per cent) and using bio fertilizer without mixing with chemical fertilizer (39.16per cent). Thus, the result indicates that there was considerable variation in the extent of adoption of biofertilizer practices by the farmers.

Anand Kumar Pathak, Jahanara (2018) studied extent of adoption of Bio fertilizer by the respondents in Bhadohi district (Uttar Pradesh) during 2017-18 in Abholi block of Bhadohi district. Six villages and 120 respondents were selected randomly and data were collected through personal interview method. Collected data were analyzed by using appropriate statistical methods were applied for the interpretation at data. It was found that majority of respondents (52.50%) had medium level of adoption followed by 30.84 per cent had lowest level of adoption followed by 16.66 per cent respondents had high level of adoption of Biofertilizer.

T. Rajula Shanthy et.al (2018) published Bio-fertilizers for sustainable sugarcane production: a socioeconomic analysis. The study examines the many sociological and economic implications of sugarcane biofertilizer use. Farmers received significant increase in net returns as a result of enhanced cane productivity. Each farmer has his or her own purpose for embracing biofertilizers: to obtain a lush green crop, healthy crop growth, and a high cane yield while lowering fertiliser costs and so increasing profit and soil health. Despite the fact that they faced constraints such as a lack of timely labour, high labour costs, and a lack of timely access to high-quality bio-fertilizers, farmers favoured the use of this technique. The study contributes to a better knowledge of bio-fertilizer performance in farmer fields and farmer attitudes toward this technology. While the researchers conclude that bio-fertilizer

application is a validated method, widespread adoption remains a challenge. Nonetheless, it was discovered in this study that timely application of bio-fertilizer results in a superior harvest and is cost-effective.

Shrotriya et al. (2001) mentioned that the approach of fertiliser industry for improving agricultural productivity was also by and large targeted to improve crop productivity through increasing the use of fertilisers and other inputs. There are certain special projects and programmes where integrated farming system approach was followed for productivity improvement. In this approach, arable farming, horticulture, forestry, livestock and pastoral production systems were usually followed.

Kaur et al. (2015) studies influence of psychrotolerant plant growth promoting growth rhizobacteria as cooculants with Rhizobium on growth parameters and yield. Study stated that Azotobacter inoculation resulted in multiplication and establishment of the culture in the inoculated field soil. Being plant growth promoting and plant probiotic bacteria Azotobacter count increase is a good sign of the improved soil microbial status and hence better soil health.

Rajula Shanthy and Subramanian (2015) stated that application of farm yard manure, biocompost and biofertilizers creates a condusive environment for the development of soil flora and soil fauna and this makes the soil healthy. Increase in cane weight could be the probable reason for increased cane yield.

Maria Ajmal et.al (2018) noted in their article biofertilizer as an alternative to chemical fertilizers that biofertilizers and biopesticides offer a sustainable alternative for reducing reliance on chemical fertilisers while satisfying the expanding population's demands. The use of biofertilizers and insecticides in place of chemicals is anticipated to have a beneficial effect on the soil, air, and water, as well as on human health. They are not only nutritionally dense, but also provide beneficial bacteria to the soil. By attaching bacteria to a carrier substance, biofertilizers enhance the efficacy of chemical fertilisers. These growing organisms, which are available in both solid and liquid phases and have a shelf life of six months to two years, promote plant development and can also be used as fish feed. Additionally, biofertilizers and insecticides have been reported to have significant draw backs. Manufacturers may encounter difficulties during numerous processes. Health hazards may also develop as a result of the possibility of heavy metal pollution. If these constraints can be solved, biofertilizers and pesticides may be a viable alternative to chemical fertilisers in terms of pollution control.

Mazid et al. (2011) biofertilizer is a substance which contains living microorganisms which when applied to seed, plant surfaces, or soil colonizes the rhizospehere or the interior of the plant and promotes growth by increasing the availability of primary nutrients to the host plant organic fertilizers contain organic compounds which directly or by their decay, increase soil fertility.

III. Research Methodology :

Both primary and secondary data were collected for the study. Primary data was collected with the help of structured interview questionnaires through field visits.

The 'structured, undisguised questionnaire' was developed from standard questions of relevant literature as a research instrument. Responses on the questionnaire were obtained through interaction in presence of the corresponding users of the biofertilizers/ farmers. So as to get the accurate and holistic information about the attitude, behaviour and satisfaction of the farmers while using biofertilizers, average data of three years period i.e. 2015-16 to 2018-19 will be considered. For this purpose, data was collected with various stakeholders;

- Representatives of Companies
- Dealers/ Progressive Farmers
- Farmers

At the final stage, the data was collected through a semi-structured interview schedule and a Focus Group Discussion (FDG) with 15 respondents, 5 from each district. The demographics of respondents included progressive farmers and dealers, in order to identify their perception and buying behaviour towards biofertilizers.

A judgmental stratified random sampling method was used for selecting the district of Western Maharashtra state. Western Maharashtra covers seven districts namely Kolhapur, Sangli, Satara, Solapur, Pune, Ahmednagar and Nashik. Out of these districts, 3 districts i.e. Pune, Kolhapur and Ahmednagar were selected for the study based on the fertilizer consumption.

IV. Data Analysis :

The data analysis section has divided into two parts as follows:

Part A - Analysis of the questionnaire with quantitative data

Part B - Analysis of Focused Group Discussion with the select progressive farmers

Part A- Analysis of the questionnaire with quantitative data

Table 4.1: Age Group of the Respondents

Districts	Number of respondents				
	21-30	**31-40**	**41-50**	**51-60**	**>61**
Pune	20	32	41	23	14
Kolhapur	22	35	39	19	15
Ahmednagar	18	31	43	25	13
Total	60	98	123	67	42
Percentage	**15.4**	**25.1**	**31.5**	**17.2**	**10.77**

Source : Primary Data.

The age of the respondent farmers is presented in table 4.1. It was observed that in Western zone of Maharashtra nearly 31.5% of the farmers were found in the age group of 41-50 years and 25.1% farmers belonged to age group of 31-40 years. Remaining 17.2% of farmers belonged in the age group 51-60 years. The 15.4% farmers fell in age group of 21-30 and only 10.77 % farmers in the age of more than 61 years.

Table 4.2 : Education Level of the Respondents

Districts	Education Level of the Respondents					
	Illiterate	**Primary**	**Secondary**	**Higher secondary**	**Graduation**	**Post-graduation**
Pune	12	18	25	30	40	15
Kolhapur	13	20	29	27	37	14
Ahmednagar	14	23	28	28	34	13
Total	**39**	**61**	**82**	**85**	**111**	**42**
Percentage	**10.00**	**15.64**	**21.03**	**21.79**	**28.46**	**10.77**

Source : Primary Data.

The educational level of farmers is presented in the table 4.2. Out of total farmers, 28.46 % farmers had completed their graduation and 21.79% farmers attained H.S.C level. Between 15%-21% farmers were completed their primary and up to secondary level. Around 10% of the surveyed farmers were illiterate and 10% were post graduates.

Table 4.3 : Annual Income of the Respondent

Districts	Annual Income of the Respondent			
	50000-1 lakh	2-3 lakh	3-5 lakh	More than 5 lakh
Pune	14	22	38	46
Kolhapur	16	24	38	42
Ahmednagar	18	26	40	36
Total	**48**	**72**	**116**	**124**
Percentage	**12.31**	**18.46**	**29.74**	**31.79**

Source : Primary Data.

Income level of the farmers in the area surveyed revealed that, in Pune, Kolhapur and Ahmednagar Districts around 31.79% farmers had annual income more than 5 lakh from agriculture and other secondary sources, almost 29.74% farmers income in the range of 3-5 lakh, 18.46% had income between 2-3 lakhs and nearly 12.31% farmers income was less than 1 lakh. Finally it's concluded that large farmers who cultivated cash crops in all districts had income more than 5 lakh. Only a few farmers had income less than or equal to 1 lakh.

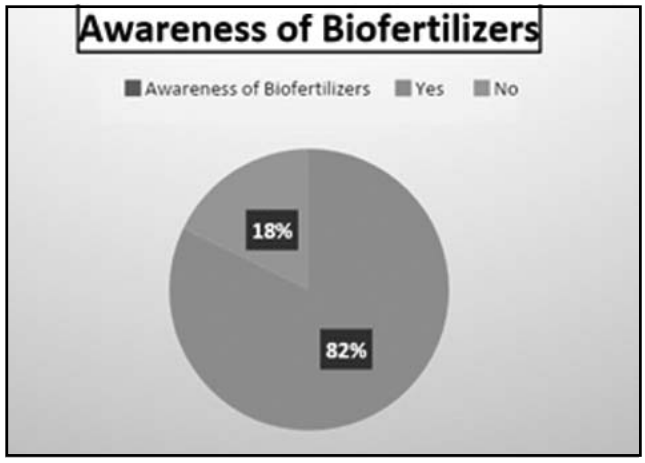
Table 4.4: Major Crops are Grown by Farmers

Major crops grown by respondents					
Food Grains	**Fruits**	**Vegetables**	**Viticlone Nursery**	**Sugarcane**	**Groundnut**
53.50%	46.50%	51.20%	2.30%	2.30%	2.30%

Source : Primary Data.

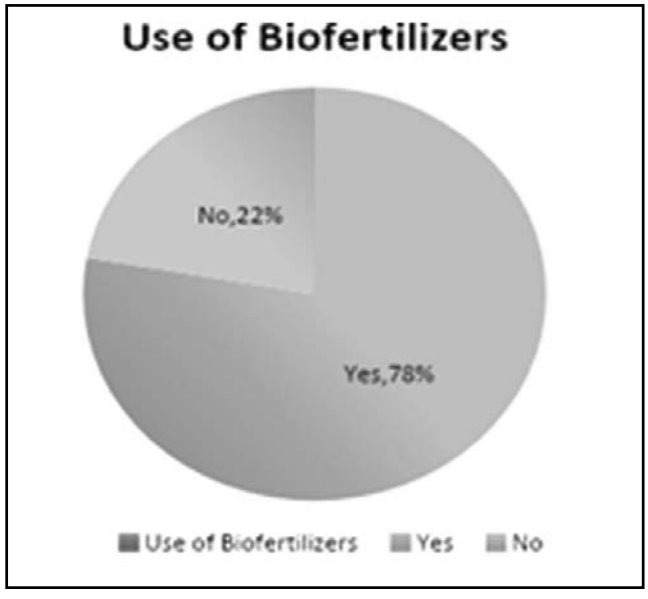
The above table indicates the major category of crops grown by the farmers in the study area. Food Grains and Vegetables are the highest categories of crops grown by the farmers at 53.5% and 51.2% followed by fruits with 46.5%. However, based on the area of study sugarcane, groundnut and viticlone nursery are also grown majorly every year. Other major crops grown by farmers throughout the year include Grapes, Oranges, Pomegranate, Wheat, Chilli, Jowar, Bajra, Maize, Brinjal, Potatoes and Bananas.

5. Awareness of Biofertilizers



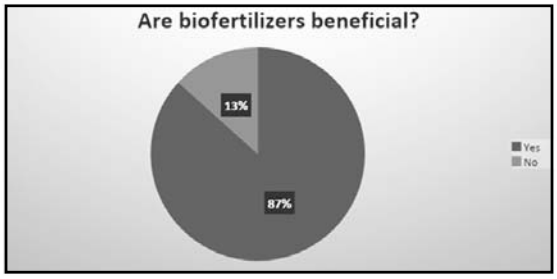
The above chart shows the awareness of biofertilizers of the respondents in the study area. It indicates that 82% of farmers were aware of biofertilizers, while 18% remained unaware.

6. Use of Fertilizers



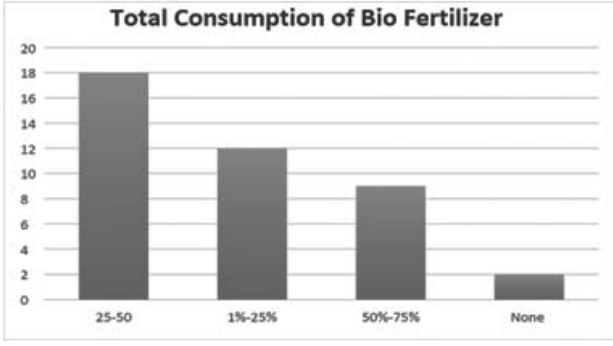
The above figure shows the use of biofertilizers in the study area. It indicates that 78% of farmers use biofertilizers and 22% farmers don't use biofertilizers, although they were aware of biofertilizers.

7. Are Biofertilizers more beneficial?



The above figure showsthat 87% of farmers felt that biofertilizers are more beneficial than other fertilizers while 13% of farmers felt otherwise.

8. Total Consumption of Biofertilizers



The above figure shows the total consumption of biofertilizers in the study area. 43.9% of farmers use 25%-50% biofertilizers overall, followed by 29.3% of farmers that use 1%-25% of biofertilizers. Meanwhile, 22% of farmers use 50%-70% of biofertilizers and 4% have no use of biofertilizers.

9. Sources responsible for the use of Biofertilizer

Table 4.5 : Sources responsible for the use of Biofertilizer

Sources	Number of respondents			
	Pune	Kolhapur	Ahmednagar	Total
Friends	28	31	33	**92(23.59)**
Agricultural press and newspaper	25	23	22	**70(17.95)**
Media	19	20	17	**56(14.36)**
Information events/ field days	15	14	13	**42(10.77)**
Governmental support programs	15	14	13	**42(10.77)**
Farm advisors	13	15	12	**40(10.26)**
Family	35	33	40	**108(27.69)**

Source : Primary Data.

Note : Figure in parentheses indicates percentage to the total.

The above analysis indicates the sources responsible for the use of biofertilizer. It shows that in total 27.69 % of the respondents are influenced by the family members for the use of biofertilizers followed by farmers friend 23.59%, agricultural press and newspaper 17.95%, Media 14.36%, Information events/ field days and Governmental support programs 10.77% and Farm advisors 10.77%.

10. Experience of the respondents towards the Bio-fertilizer

Table 4.6 : Experience of the respondents towards the Bio-fertilizer

Sl. No.	Particulars	Number of respondents			
		Pune	Ahmednagar	Kolhapur	Total
1	Economical	56	65	75	196(50.26)
2	Good quality	68	63	63	194(49.74)
3	Costly	36	33	32	101(25.90)
4	Poor quality	33	28	30	91(23.33)
5	High yield	70	69	72	211(54.10)
6	Low yield	37	42	28	107(27.44)

Source : Primary Data.

Note : Figure in parentheses indicates the percentage to total.

The above table indicates that the perception towards the product varies from person to person. In the above analysis it was observed that about 54 percent of the respondents having perception that bio-fertilizer products having High yield and about 50% percent of respondents having perception that economical and good quality one, in other side very few respondents were having perception of Low yield 27.44 %, Costly 25.90% and Poor quality 23.33% from the Western Maharashtra. The perception of most of the respondents towards the IFFCO's biofertilizers is Economical, Good quality and giving high yield when combine with other fertilizers.

11. The Rank of Factors considered while Purchasing Biofertilizers

Table 4.11: The Rank of Factors considered while Purchasing Biofertilizers

Factors	1	2	3	4	5	6	Total
Past Experience	220	90	25	20	25	10	390
Price	112	55	40	40	47	96	390
Product Quality	65	65	95	50	50	65	390
Easily Available	65	65	65	65	65	65	390
Brand Image	44	30	33	30	133	120	390
Credit	20	15	40	40	95	170	390

Source : Primary Data.

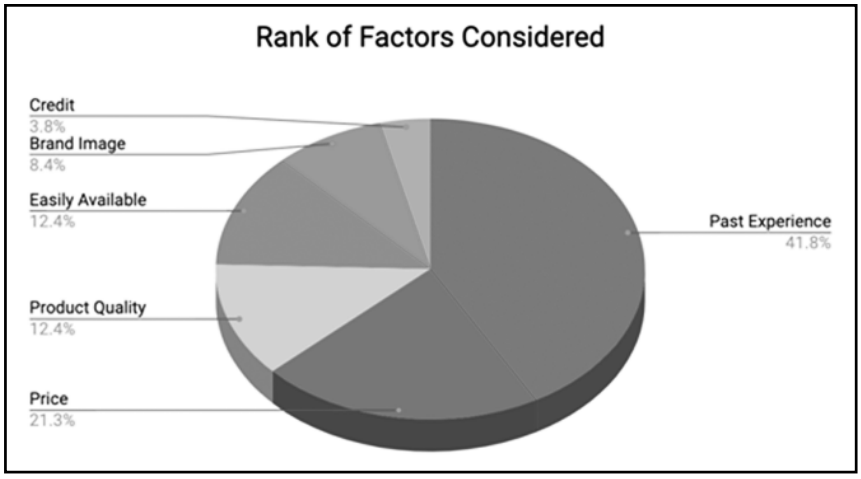


Figure : Rank of factors considered

From the table it has been depicted that the farmers were influenced more to buy biofertilizers due to their past experience; this can signify their satisfaction level with biofertilizers followed by quality of the product and price which attracts farmers to purchase biofertilizers as opposed to factors like availability, credit and brand image which were ranked low by the respondents.

12. Estimating Market Potential

Market potential is an estimate of the amount of money companies can expect to make from the product or service they plan to market. Estimating the market share or potential will allow biofertilizer companies to determine if their markets will support their businesses by covering their costs.The general formula for this estimation is simple :

Estimating Market Potential - MP = A x C x P

Where:

MP = Market potential.

A = Total estimated area under bio fertilizer

C = Average annual consumption (Doses Required (Kg/acre) of bio fertilizers)

P = Average selling Price of the product

Therefore,

MP = 15acres x 350kg/acre x Rs.3000

MP = (15 X 350 X 3000) = 15, 750,000 kg/acre

Generally, the market potential is the highest estimated net revenue that companies will realize from their enterprise. The market potential is the number

of potential buyers, an average selling price and an estimate of usage for a specific period of time.

Part B – Analysis of Focused Group Discussion with the select Progressive farmers

A focus group discussion was carried with 15 select progressive farmers and dealers to understand their best practices and adoption behaviour towards biofertilizers. The Findings and Suggestions from the discussion have been mentioned in the following sections along with the interviews conducted with 4 award winning progressive farmers which is documented in the form case study (Annexure).

V. Findings

The following section discusses the findings of the collected data from farmers in Pune, Ahmednagar and Kolhapur. The analysis conducted with farmers throws some light into the progress and usage of biofertilizers. The empirical findings can be summarized as follows.

1. Demographics :

The Demographic profile of the respondents illustrates that the majority of the farmers' age group is in the range of 41-50. A higher number of respondents have completed their higher education and graduation. Lastly, large farmers who cultivated cash crops in all districts had income more than 5 lakh and the land holdings higher than 5 ha. Major category crops grown by the respondents included food grains and vegetables.

2. Use of Biofertilizers :

A very high number of respondents are aware of biofertilizers. Amongst Biofertilizers, Chemical fertilizers, Organic compost and Other types of fertilizers, respondents prefer using Chemical fertilizers compared to other fertilizers. However, several respondents have reflected that they use biofertilizers and chemical fertilizers simultaneously and observe that biofertilizers are beneficial for the solid and plants. Only 22% of farmer respondents' total consumption of biofertilizers is more than 50%-70%.

The respondents mention that Family, Friends, Newspaper and Media sources are some of the most influential factors responsible for using biofertilizers. However, their perception of biofertilizer products varies from person to person, yet the majority of farmer respondents observed that bio-fertilizer products result in High yield.

3. Market Potential :

Determining the market potential of a product is part of a successful marketing process and requires marketing research. The findings suggest that the market potential for biofertilizer in Western Maharashtra is 15, 750,000 kg/acre.

4. Buying Behaviour :

The finding from buying behaviour depicts the factors taken in consideration while buying biofertilizers. Past Experience has been ranked the highest amongst all the other factors followed by price of the product. They have been viewed to influence their purchase decisions. Willock et al. argued that farmers can recursively modify their buying behaviour in response to the arrival of information about the outcomes of their purchases, thus justifying that past experience with a product plays a crucial role. While product availability, Credit and Brand Image didn't make significant role in their purchase decisions.

5. Focus Group Discussion :

Based on the primary data collected through formal interaction with various stakeholders, the researchers have laid down the following issues and challenges faced by Representatives of companies, Progressive Farmers and Dealers.

Issues and Challenges :

- **Open market policy :** It is likely that after complete decontrol in any market, it tends to increase the prices of commodities. Fertilizers are also no exception in this regard. This open market policy is hampering the sales volume and market of biofertilizers.
- **Competition from private players :** The private players have attractive offers to sell fertilizers on a credit basis, whereas cooperatives offer in cash only. This leads to an increase in the sale of fertilizers from private even though farmers end up at higher prices.
- **Overdue :** Some amounts of inputs are provided on a credit basis. The farmers are unable to repay it within the stipulated time period, so they face the challenge of overdue and recovery.
- **Declining business volume over a long period :** The existence of unfair competition and low margin in sales of biofertilizers are affecting the performance. The unfair price as a result of unfair competition is limiting dealers' scope of services and competitiveness in the market, and it affects the overall business of the companies.

- **Improper Marketing Structure :** Efficient marketing is required for the smooth functioning of any product. Improper marketing structure tends to have higher costs and become inefficient and/or provide poor quality services.
- **Reduction of Subsidy on fertilizer by Government :** The net result has been an overall increase in fertilizer prices, with neither the government benefiting due to subsidy reduction nor the farmer benefits. As a result, biofertilizer prices more than doubled in the last four years.
- **Reduction in Marketing Structure :** The 3-tier structure, i.e. State Marketing Federations District Sales and Purchase Cooperatives and Block level sales and purchase cooperatives, have been reduced to 2–tier structure, i.e. State and Block level, which has hampered the sales volume.
- **Market information and Technology :** Lack of information on the current market and technology is also one of the most important challenges that put its massive suppressive effect on the marketing of biofertilizers input and output of farmers and dealers. Due to lack of current information, the farmers are not benefiting from the price of agricultural inputs, the major problem for inhibiting getting the optimum price level for both agricultural input purchase time and agricultural output marketing times.
- **Infrastructural Challenges :** The infrastructural challenges are challenges that hinder the well-functioning and facilitation of companies due to lack of availability of trained manpower, lack of information on the current market, lack of mass-medias for communication purposes, lack of market infrastructure, shortage of store and transportation facilities shortage of linkage with financial institutions and shortage of technology.

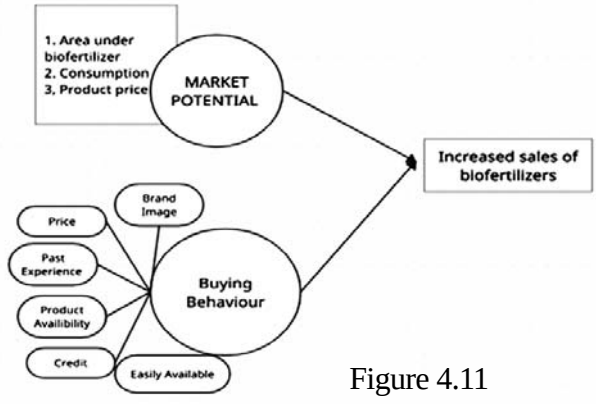


Figure 4.11

Factors of Market Potential and Buying Behaviour influencing the sale of Biofertilizers

Source : Author's Compilation based on data analysis.

VI. Suggestions :

A. Suggestions based on Focus Group Discussion:

The researchers have also sought the opinion and advice of the respondents for the growth of sales and purchase about biofertilizers. The same has been compiled and presented in the following section of the study.

- **Innovative Distribution Policy.** Efficient distribution should require so as to ensure that biofertilizers are available to the farmer at the right time and at the optimum price, consistent with the provision of reliable service and active marketing, which is a continuous process whereby the distributors are constantly looking for new ways to increase sales of fertilizer to benefit not only themselves but also the farmers. Many of the private companies provide home delivery to the farmers. Dealers should peek into these initiatives.
- **Market Linkages :** Farmers are in direct touch with the dealers. Thus dealers are a better option for using tools of inters personnel communication. Whereas manufacturers reach to their customer farmers is not that direct, close and frequent, hence channels of mass communication are to be used between them. Inter personnel communication is largely related to promotional aspects leading to the adoption of fertilizers use, and mass communication limits itself to publicity aspects leading to the creation of awareness. The linkages between manufacturer, dealer and farmer need a rethinking with the recognition of such partnership. Dealer's involvement in promotional work appears to be a necessity in the changed circumstances sales, and purchase cooperatives should focus on market connections by frequent meeting with block and primary level dealers.
- **LAB to Land :** Companies should organize various LAB to LAND visits to facilitate farmers who help to transfer the latest proven and viable agricultural technology from input manufacturers to the farmer's field, and the biofertilizer retailer is in direct contact with the farmer and is well placed to give advice on the use of the products he sells, nutrient deficiency and requirement of soil, etc.
- **Training and Development Initiatives :** Education and Training that have to be provided to farmers and dealers. They should take training related to technology and marketing at least once a year. Three levels of training are required for the effective implementation of fertilizer marketing policies :

i) Training of senior managers must emphasize how biofertilizer marketing functions can be carried out effectively and how each can be integrated into a total fertilizer marketing system.

ii) The fertilizer distributors, i.e. private dealers and/or staff of cooperatives, must be trained to operate a fertilizer retailing business and be provided with appropriate knowledge of fertilizer use, thus enabling them to assist their farmer customers in making sound fertilizer purchasing and application decisions.

iii) Technical staff and labourers need to be trained in necessary skills, ranging from sales estimation and store-keeping to the more menial tasks of loading and offloading fertilizer without damaging the bags and spilling fertilizer material.

- **Developing IT Infrastructure :** Several members of the fertilizer industry have created their websites and also launching agricultural information portals. However, these have to be further enriched with content, farmer's friendly touch screen technology, etc. There is a need to coordinate such activities, and different websites of the fertilizer industry could provide connectivity to each other and always take advantage of the information provided by a fellow member. Similarly, there is a need to strengthen and expand the delivery system Digitalization is required, and for that, societies should have to develop an APP for all dealers or Farmers. This can be leveraged for business purposes as well promotional services.

B. Suggestions based on Data Analysis:

- **Simultaneous use of bio and chemical fertilizer**

Even though bio-fertilizer is superior to chemical fertilizer in terms of sustainable agriculture, its complete replacement in place of chemical fertilizer is not possible. A modality of the balanced path that involves the combined use of chemical and bio-fertilizer can be evolved. (Young et al. 2003) studied the effects of a combined treatment of multifunctional biofertilizer plus 50% chemical fertilizer on lettuce yield. From their results it is observed that there was a 25% increase of lettuce yield for the treatment of ½ chemical fertilizer plus biofertilizer compared to that of the chemical fertilizer treatment, indicating that at least 50% of chemical fertilizer can be saved as multifunctional biofertilizer was used along with chemical fertilizer. Again employment of multifunctional biofertilizer on rhizosphere microbial activity and the growth of water celery in a field showed that the dry weight of water celery

in the treatment with 50% organic compound fertilizer with multifunctional biofertilizer was increased by 34% compared to the treatment with 100% organic compound fertilizer [Young. et. al, 2004].

- **Role of Government in bio-fertilizer production :**

The Government of India and the various State Governments have been pushing the use of biofertilizers with differing degrees of focus through grants, extension, and sales subsidies (Alam, 2000). Farmers gradually acquire knowledge about technology, basing their perceptions on the agronomic realities of their regions, the knowledge gained from the experiences of other farmers, including themselves, and the information provided by various disseminating agents, and forming their own adoption decisions. (Khan et al., 2011c). The GOI has provided the National Biofertilizers Development Centre at Ghaziabad with six regional centres at Bangalore, Bhubaneswar, Jabalpur, Hisar, Imphal and Nagpur. In the absence of reported information on farm level use of the inputs, this can help in understanding the progress of the usage of biofertilizers and its adoption in India. There has practically been no diffusion of the technology despite the central government's interventions and the distribution among units has tended towards greater concentration especially in Maharashtra and other States of the West and South.

Despite the lack of expected response there still is a strong case for the government to intervene and possibly subsidize in the market. The reasons can be broadly classified into two groups: Social gains or 'First best' reasons if biofertilizers impart certain social and long-term gains for which private individuals may not be willing to pay at least until the gains become 'visible', there is a rationale for spreading the cost over a larger group of beneficiaries or the society at large (Yokell, 1979).

Even if the market is otherwise competitive, the government can act on behalf of society through appropriate policy.

i) Biofertilizers have significant environmental and long-term ramifications, as they counteract the negative effects of pesticides. At the farm level, improved use of technology can benefit other farms and sectors by reducing water pollution caused by chemical fertilisers and, to a lesser extent, organic manures.

ii) The benefits of new technology in terms of reversing soil damage may take time to manifest, in contrast to chemical fertilisers, which provide immediate returns.

Simultaneously, the farmer must spend a significant upfront cost in terms

of skill learning, trial and error, and risk. Adoption may be delayed and heavily impacted by neighbours' experiences over time in rural environments, where actors frequently operate with constrained rationality. Empirical evidence from agriculture around the world indicates that new methods take time to spread, and early adopters are frequently conservative about the percentage of acreage allocated to the new technology (Griliches, 1957). The state can play a role in encouraging farmers to adopt more efficient practises.

iii) The producer firms have serious uncertainty about the demand or saleability of the product, which deters investment, particularly if it is irreversible (Guiso and Parigi, 1999). The success or failures of early entrants who take the initiative or those who indulge in research for an improved product convey important information to others (Stiglitz, 1989) and there by to society. The market however does not always reward the initiative. The capital market is also not always ready to provide risk capital at reasonable rates.

- **Non-competitive Market or 'Second best' Reasons :**

In many cases, the market itself is not competitive and although the first-best solution would be to promote competition, there are other ways of dealing with the situation.

1. Although biofertilizers have been promoted as a supplement or complement of chemical fertilizers, in reality, they are two alternative means of accessing plant nutrients. The strength of complementarity as against substitution between the two inputs is open to empirical verification, but there is no denying that farmers and producers do perceive the substitutability relation to an extent. The pricing of chemical fertilizers is far from marginal cost-based. In particular, urea is under administrative pricing and there are serious economic and political compulsions to continue the protection although the movement in spirit has been towards openness. In such circumstances, the price of biofertilizers along with the risk and responses will be weighed with those of chemical fertilizers, and promotion of the technology for environmental reasons would call for some degree of protection to minimize the inter-fertilizer price distortion.
2. The external or environmental cost of using chemical fertilizers, though not measurable may also be taken into account when comparing with biofertilizers if the later is to be promoted. It is a good practice to promote biofertilizers as an input conjunctive to other forms of fertilizers, but keeping in view the protection given to chemicals, there is some ground for

subsidizing the former to encourage their use. The promotion of bio-fertilizer also needs extensive extension work to convince the farmers about the need for bio-fertilizer use to increase productivity. Seminars on bio-fertilizers and micronutrients are regularly being organized by Govt. of India which are attended by executives of fertilizer industries, agriculture research and extension specialists, academicians, administrators, policymakers and progressive farmers. Marketing bio-fertilizer is a very difficult task as they are not primary inputs like seed and fertilizer. Again, progressive farmers' acceptance of bio-fertilizer use has been far from satisfactory. This is the main reason why effective demand has not been created so far. Even in a few cases there is a demand for biofertilizer but it's limited to few varieties like Rhizobium, Azotobacter, and Phosphorus Solubilizing Microorganism.

However, there is a need to work out a systematic and uniform way to give out subsidies so that they do not distort inter-unit prices and help some units at the cost of others. The States should be strongly guided on this norm. The main purpose of the subsidies would however be to induce farmers to try out the input at affordable and acceptable prices rather than to support certain producers directly. As far as producers are concerned, healthy competition would only help develop a market in the long run and benefit the farmers. Open sales in the market may be encouraged to improve the capability of the units in marketing products. Any attempt to fix a minimum price for the sake of quality or other consideration will only go against the spirit of competition and harm the interests of the industry and the farmers. The present study finds some but not conclusive role of the price factor but scientific studies may be conducted on the farmers' 'willingness to pay for the new input to determine the need and extent of subsidies.

- **Marketing challenges & Options in the biofertilizers business :**

In spite of being cost-effective input, Bio-fertilizers have not been accepted by the farmers completely till now. Some of the reasons/constraints for low acceptance of Bio-fertilizer are narrated below. However, the "Liquid form" has overcome a few limitations and has provided opportunities for Marketers. As an unavoidable component of sustainable agriculture, biofertilizer technology must meet the fundamental requirements for its primary aspects. The technology for biofertilizers must be as follows:

a. Appropriate: in accordance with the end-users' social and infrastructural circumstances;

b. Economically possible and viable: appropriate to all farmers, regardless of their financial situation or position, with regards to return on investment;

c. Environmentally friendly: contributing to the enhancement of the environment or, at the very least, not impairing existing agro-ecological conditions;

d. Stable: the technology's beneficial aspects must stay stable over time;

e. Efficient: method of converting inputs into useful and environmentally friendly outputs;

f. Adaptable: capable of being adapted to current local conditions;

g. Socially acceptable and sustainable: agreeable to various elements of society and meeting individual requirements;

h. Administratively manageable: practicable within the confines of a particular bureaucratic framework;

i. Culturally desirable: conforms to society's many cultural trends;

j. Renewable: capable of being used and re-used without requiring considerable extra inputs;

k. Productive: rate and amount of output per unit of land/input; yield per unit of area (or labour input, or investment) as a sustainable agricultural component.

However, the successful promotion of biofertilizer technology in sustainable agriculture is contingent upon the execution of programmes aimed at increasing knowledge among producers and consumers of biofertilizers. Biofertilizers appear to be a sustainable and farmer-friendly source of low-cost agro-inputs.

Biofertilizers are also gaining popularity due to their potential for use in sustainable agriculture. However, many of the items available on the market today are of poor quality. The formulation of an inoculant is a multistep procedure that results in the inclusion of one or more strains of microorganisms in a suitable carrier, protecting them from harsh storage conditions and ensuring their survival and establishment following introduction into soils. A critical aspect of formulation development and production is product quality control at each level of the manufacturing process.

The final biofertilizer product must have significant quality management effects. These impacts are utilized to determine the biofertilizer's characteristics. The list of important consequences must include those associated with the biofertilizer's guaranteed activities. Thus, a mechanism must exist that distinguishes between resident microorganisms, targeted microorganisms, and the effect of extra components on the biofertilizer's effects.

To assure the quality of biofertilizers, the following quality control restrictions must be considered: legislative, environmental, technological, and lack of awareness. Additionally, regular training sessions must be organized by national/regional organic farming centres. Training modules for laboratory analysts, field level officers, and fertilizer inspectors must be developed and executed as part of the quality control systems that ensure efficient inoculant production and application.

- **Progressive Farmers as tool of Awareness**

Progressive farmers are considered very strategic. They have many advantages, including knowledge and stronger technical skills, because they are direct actors in the field. Progressive farmers are better able to carry out participatory education because they live with farmers, able to organize the community because they are directly involved in many farmer organizations, act as stronger change agents because they have social capital, can be potential business agents and can teach technology and farming skills more precisely because they have technical knowledge from direct experience as farmers in the field (Syahyuti 2014). The other advantage of a progressive farmer agent is the existence of more community beliefs to guide and convey information (Lukuyu. 2012; Samuel. 2012; Kiptot and Steven2015). Such advantages of progressive farmers and the current condition of government agricultural extension agents are limited, thus progressive farmers can be an alternative to complement and strengthen their role as change agents in rural areas.

Progressive farmers have the ability to regenerate farmers in the agricultural field. Progressive farmers can be good examples and motivators for young people to work in agriculture. On the other side, the regeneration of agricultural actors is very important because the data shows that the portion of young farmers is much more lower than older farmers Haryanto (2016) and Anwarudin and Haryanto (2016).

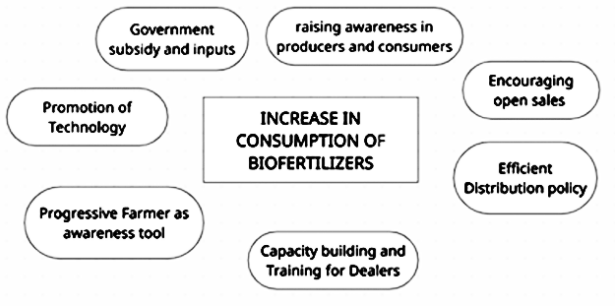


Figure. 4.12. Approaches to increase biofertilizer consumption
Source : Authors compilation based on results of data analysis.

Conclusion :

There is no doubt that bio-fertilizers are the potential tools for sustainable agriculture not only in India but also globally. Biofertilizers are low cost inputs with high benefits in agriculture. There is a need to popularize this low cost technology with the farming community to reap higher dividends. Biofertilizers have a potential role in sustainable agriculture; these can be used along with chemical fertilizers to enhance the soil fertility and crop yield. In India, farmers' specially marginal farmers can get more profit from the same size of land by using biofertilizers instead of application of chemical fertilizers alone. The use of bio-fertilizer in preferences to chemical fertilizer is always welcome taking into consideration the sustainability of agriculture and its eco benefits. It is beneficial also in terms of soil fertility, ecological balance etc. As the use of bio-fertilizer, till so far, is grossly inadequate in India, more emphasis on its production, consumption and also proper distribution need to be taken into consideration. However, most farmers are not aware of it; therefore, to popularize this technology training should be provided to the farmers and this can be done through demonstration trials on the cultivator's fields. In this case, extension workers would play an important role.

Progressive farmers to whom, we paid particular attention in this study. Our main criterion for 'progressiveness' is the Best practices and agricultural performance of the farmer. Wherever the development process becomes more dynamic, a group of progressive farmers appear, who get higher net returns from their holdings than do the mass of farmers because they make a more; rational use, of their production factors and adopt technical innovations more quickly. The case studies referred to in this paper clearly indicate that the mentioned best practices i.e. Soil testing, use of speciality fertilizers, diversified cropping pattern, modern irrigation technology, maintain farm record, social participation, and collective farming followed by farmers are responsible for their progressiveness and they have also suggested other practices which are helpful to the other farmers for their progress. Hence progressive farmers can be role model for other farmers to showcase their best practices technologies, skills and ideas to make farming more profitable.

Moreover, more researches are needed to identify crop and location specific microbial strains with higher efficacy. The government should introduce strict law and policy against the quality of biofertilizers so that farmers can get benefits of this technology. As the business matures under governmental leadership, the following observations are expected: (a) increased sales volumes and distribution across the country; and (b) a greater role for profit-motivated

private enterprise. Due to the fact that farm-level biofertilizer use and profitability of units are not reported to date, one approach to proceed is to monitor the secondary indicators included in (a) and (b) (b). Public involvement, whether monetary or otherwise, is appropriate in order to develop a market for an input that has the potential for social and long-term gains. Any government policy would place a premium on increasing farmer adoption through varietal development, information dissemination, risk covering, and sales subsidies, if scientifically warranted. Acceptance from farmers would go a long way toward supplying advertisements.

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Annexure :

Case Studies :

Best practices of Progressive farmers

Case 1 :

Mr Rishikesh A. Meher aged 46, resident of Warulwadi village near Narayangoan of Junnar taluka belongs to the Pune district of Maharashtra. This village is mainly located in a highly hilly area and the vicinity of rivers like Pushpawati, Meena and Kukadi respectively. The location of Narayangaon is along the Nasik-Pune national high way. He Educated up to graduation and own 12 acres of land. The soil of the land is calcareous. He is mainly cultivating fruits crops. The sources of water are an open well and a farm pond. He has 20

years of experience in farming. Most of the labour requirement met through family members and hired labour only during the peak period of the crop. He is participating in different social organizations related to agriculture. There is an export group in the village whereas he is a pioneer of the group. He is participating in different types of workshops, seminars and training programmes related to agriculture. He is always connected with KVK, Narayangoan and Agriculture scientist and experts to seeking guidance related to agriculture technology. He is trying to maximum the use of organic fertilizers as much as possible so he has prepared organic manure, FYM, compost at their field only. He always paying attention to reduce the use of chemical fertilizers.

Best practices:

- **Water-soluble fertilizer :** He is always using water-soluble fertilizer because it is less expensive and give a quick result
- **Farm pond and Drip irrigation technology :** He has a farm pond on their field and using drip irrigation technology
- **Soil testing :** He is regularly doing soil testing at KVK to know the requirements of soil
- **Farm record :** He always maintains their farm record to know the Income and expenditure from farming.
- **Social Participation :** He is always participating in workshops, group discussion and seminars arranged by KVK, input companies and agriculture universities and connected with KVK, input dealers and mass media for information on new agri techonlogy.
- **Reduce the use of chemical fertilizer :** He using Water Soluble fertilizers and increase the use of biofertilizers, compost, FYM etc. and reduces the use of Chemical Fertilizers
- Export Group: He has formed an export group and Exporting their grapes to European countries

Award : Krishibhushan Krishiratna

Suggestion :

He has given a very kind suggestion to the other farmers for their progress. crop management is a must increase the output. Farmers should increase the use of water-soluble fertilizers which are easily absorbed and give a quick result. Farmers should maintain their daily farm record. There is a need to create awareness for the use of biofertilizers. The government should provide subsidy for fertilizers group discussion of farmers influence on the progressiveness of

the farmers. Only one demo is not sufficient for creating awareness among the farmers for the new product. Input companies should arrange season-wise as well as different types of demos .i.e. plant protection, nutrition etc. There should be a frequent visitor of field officers at a field plot or farmers field. Input companies should arrange a maximum workshop, seminars and demos, a field trial for new products. There is a need to reduce the supply chain in the case of FPO.

Case 2

Rahul S. Bankar, Aged 43 resident of Warulwadi village near Narayangoan of Junnar taluka belongs to the Pune district of Maharashtra. This village is mainly located in a highly hilly area and the vicinity of rivers like Pushpawati, Meena and Kukadi respectively. The location of Narayangaon is along the Nasik-Pune national high way. He educated up to graduation and own 15 acres of land. The soil of the land is calcareous. He is cultivating fruits crops like grapes, banana and cash crop i.e. Sugarcane. He is using different types of chemical fertilizers as well as Bio-fertilizers. The sources of water are the well and canal. He has 18 years of experience in farming. His wife is the primary teacher. He is participating in different social organizations related to agriculture. He is always connected with KVK, Narayangoan, College of Agriculture Narayangoan and Agriculture scientist to increase awareness regarding new technology. He frequently visited NRC grapes (National Research Centre for Grapes) to know the innovative practices and technology in Grape cultivation. The research advisory committee of ICAR visited his field to see the different varieties of grapes at that time he had 30 varieties of table grapes and out of these, he has recommended 4-5 varieties. Input companies are always working on his farm for the trial of new products as well as chemical fertilizers and biofertilizers and continuously take follow up by visiting 2 times a week. Apart from this, he is doing horse business and for this frequently visited a different state. He is exporting the highest quality of grapes from the Junnar Block.

Best practices :

- **Speciality fertilizer :** He is always using water-soluble fertilizer and biofertilizers because these are required in less quantity and give a better result and always ready to try a new product.
- **Group purchase :** He is always purchasing seeds and fertilizers in the group.
- **Micro-irrigation :** He is using drip irrigation technology at their field which helps to save the water

- **Soil testing :** He is regularly doing soil testing at KVK to know the deficiency of nutrients
- **Farm record :** He is maintaining their farm record to know the profit and loss from the farm business
- **Social Participation :** He is always participating in workshops; group discussion and seminars arranged by KVK, Input companies and Agriculture universities and connected with KVK, input Dealers and Mass Medias for information on new Agri.technology
- **Diversification :** He is doingHorse business as a diversified activity other than farming
- **Export :** He has exported 95 per cent of grapes to China, Srilanka, South East Asian countries

Award : Shivneri Bhushan

Suggestion :

Farmers should use fertilizers as per the demand of the soil. There is a need to reduce the use of chemical fertilizers and increase biofertilizers, bioagents etc. Farmers should maintain their daily farm record.Farmers should be connected with institutes and companies related to Agriculture for the information of modern technology.Farmers should participate in Group discussion, Seminar; workshop etc. Farmers should use a smartphone to create a group to exchange their ideas. The company should arrange demos for catching the markets and field officers should visit 2 times a weekat the farmer's field todisseminate modern techniques. Cropsmanagement should be done as per the demand of the market.

Case 3

Balasaheb N. Chaskar, Age: 45 resident of Chaas village near Narayangoan of Junnar taluka belongs to Pune district of Maharashtra. This village is mainly located in a highly hilly area and the vicinity of rivers like Pushpawati, Meena and Kukadi respectively. The location of Narayangaon is along the Nasik-Pune national high way. He Educated up to graduation and own 15 acres of land. The soil of the land is calcareous. He has a diversified cropping pattern. He is cultivating Tomato, Sugarcane, Ginger and different types of vegetables. The sources of water are the river and Canal. He has 10 years of experience in farming. He is using different types of chemical fertilizers as well as Bio-fertilizers especially he is using Gomutra (Cow dung) as an organic fertilizer. He has done mulching on their field. He is doing mixed farming i.e. farming +Dairy. He is participating in different social organizations related to agriculture. He is always connected with KVK,

Agriculture institutes and Agriculture scientist to know the innovative technology in agriculture. He is a member of the farmer group and there are 20 members in that group doing collective farming.

Best practices:

Collective farming : He is doing collective farming with a group of 20 farmers.

Shares of IFFCO : Primary society of Chaas village having IFFCO shares for the purchase of inputs

Diversified cropping pattern : Diversified cropping pattern can increase the fertility of the soil and give continuous income to the farmers

Mixed farming : He is doing Dairy business with farming as a supplementary business helpful to increase farmer's income.

Soil testing : He is regularly doing soil testing to check the requirement of soil.

Technology : He has Drip irrigation technology and done mulching on their field to maintain the soil moisture.

Farm record : He has maintained their farm record to know the profit and loss in the farm business

Social participation : He has participated in many workshops, Seminar and connected with different agriculture group on social media, Agril. Officers, Field officers, Scientist, KVK, Social media etc. for information on new Agricultural technology

Export : He is exporting their Ginger to Gujarat

Award : Shetinishtha

Suggestion:

- Farmers should follow a diversified cropping pattern
- There is a need to do mixed farming
- Farmers should maintain their daily record
- Farmers should do collective farming and prepare groups on social media to interchange their ideas, knowledge and information
- Input company should arrange maximum demos on farmers field for their new products.
- Field officers play important role in sales of fertilizers so need to arrange meetings, seminar etc.
- Export of farm produce should be done as per market demand.

Case 4

Dr. Netaji Mahadev Patil, MD, Karbharwadi Agro Producer Company Age: 45 resident of village Karbarwadi, Taluka Karvir, Dist: Kolhapur. The village is located It is situated 13km away from Kolhapur, which is both district & sub-district headquarter of Karbharwadi village. SadoliKhalsa is the gram panchayat of Karbharwadi village. The total geographical area of the village is 69.31 hectares. Karbharwadi has a total population of 404 peoples. There are about 71 houses in Karbharwadi village. As per 2019 stats, Karbharwadi villages comes under the Karvir assembly & Kolhapur parliamentary constituency. He is a PhD and working as a professor at Shivaji University, Kolhapur. He owned 1.5 acres of land and cultivating Sugarcane and rice crops. He has 20 years of experience in farming. The main source of the water is a drip irrigation system. There is a common drip irrigation system for the whole village. He shared that 400 houses in the karbarwadi village out of these 131 farmers adopted drip irrigation all the system is fully atomized. There are 65 beds of vermicompost in the whole village. We have reduced ridges and furrow size which help to increase yield. He is using the chemical as well as biofertilizers, especially IFFCO. He is actively participating in workshop and seminar arranged by the input companies, agriculture college and KVK. He is always connected with KVK, Agriculture institutes and Agriculture scientist, Agriculture officers and field officers to know the innovative technology in agriculture He is the leader of Karbarwadi village and promoted to the other farmers for reducing the use of chemical fertilizers and adopting Biofertilizers. In this village 80% of farmers doing organic farming. He is the leader of Karbharwadi village and established Karbharwadi Agro Producer Company. All farmers of the village has marketed theirs produces through this company. He also guides the farmers to do collective farming as well as organic farming which make farming profitable. This village is called as “Model Village of IFFCO”.

Best practices:

Micro-irrigation system : There is one common drip irrigation system for all village. Jain has supported this project.

Vermicompost Bed : He has a vermicompost bed at their farm and there are 65 beds of vermicompost from a 71 family

Collective farming : He is doing collective farming with all farmers of the village.

Biofertilizers : He is using Biofertilizers of IFFCO and trying to make 100% organic farming.

Diversified cropping pattern : Diversified cropping pattern can increase the fertility of the soil and give continuous income to the farmers. He produces vegetables with cash crops.

Mixed farming : He is doing Dairy business with farming as a supplementary business helpful to increase farmer's income.

Farm Record : He has maintained the farm record and arranges a meeting every Independence day for checking the account and farm record of the village.

Soil testing : He is regularly doing soil testing to check the requirement of soil.

Technology : He has Drip irrigation technology and done mulching on their field to maintain the soil moisture.

Social participation : He has participated in many workshops, Seminar and connected with different agriculture group on social media, Agril. Officers, Field officers, Scientist, KVK, Social media etc. for information on new Agricultural technology

Karbarwadi agro Producer Company : He has established karbarwadi agro producer company and marketing their products through this company.

Award : Krushibhshan from Aviskar foundation, Member of Kolhapur Jilha Jal Arakhada committee, Krushibhshan form Agriculture department Kolhapur.

Suggestion:

- Farmers should give preference to the organic farming
- Farmers should follow a diversified cropping pattern
- There is a need to follow micro-irrigation technology
- There is a need to do mixed farming
- Farmers should maintain their daily record
- Farmers should do collective farming and prepare groups on social media to interchange their ideas, knowledge and information
- There is a need to prepare manures at the farmer's field.
- Input company should arrange maximum demos on farmers field for their new products.
- Field officers play important role in sales of fertilizers so need to arrange meetings, seminar etc.
- Export of farm produce should be done as per market demand

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