

Adoption Behaviour of Farmers towards Bio-Fertilizers in Paddy

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ABSTRACT

The present study was conducted in Bhandara district of Vidarbha region with sample size of 120 respondents from 12 villages. After statistical analysis it was observed that majority of respondents (83.33%) had medium level of knowledge regarding bio-fertilizers while 69.16 per cent respondents had medium level of adoption of bio-fertilizers in paddy. Average bio-fertilizers knowledge of respondents was 57.91 per cent, however their adoption was only 39.56 per cent. That indicates the gap in knowledge and adoption of bio-fertilizers by paddy growers. Vast majority of respondents (93.33%) were found in moderately favourable attitude towards use bio-fertilizers. In the constraints analysis lack of training to use bio-fertilizers, lack of farmers' confidence, lack of timely availability and non availability of bio-fertilizers at local level were the major constraints faced by the farmers in study area.

Key words : Knowledge, Attitude, Adoption, Bio-fertilizers

The term "Bio-fertilizer" has been coined to embody all such microorganisms, which add, conserve and mobilize the plant nutrients in the soil. based on renewable energy sources and are eco-friendly. The use of bio-fertilizer is the recent attempt in increasing yields of different crops. Bio-fertilizer not only fix atmospheric nitrogen or solubilised phosphate in the soil but also helps to maintain soil fertility, improve soil structure, texture and water holding capacity.

In view of increasing demand for plant nutrient efforts are being made to explore different sources. The use of bio-fertilizer a carrier based products containing fertility adding microbes play important role as supplementary renewable and non-polluting sources of nutrients. The application of bio-fertilizer increase crop productivity as well as soil fertility, by way of fixing atmospheric nitrogen and solubilising insoluble phosphate present in the soil biologically along with production of growth hormones and vitamins. Despite of having various potential activities, bio-fertilizer yet did not get farmers acceptance adequately. Increasing attention is being paid to this renewable source of plant nutrients because of depleting or fossil fuel availability high cost of fertilizers and their adverse effect on soil fertility and decreasing availability of organic manures due to its limited use.

The government of Maharashtra is one step ahead to popularise bio-fertilizers. To promote the use of this low cost technology, provision is made by the Government to distribute the packets of bio-fertilizers among the farmers on 50 per cent subsidy basis.

The present investigation was conducted on adoption behaviour of farmers towards bio-fertilizers in paddy. In the present study emphasis was given on the measurement of knowledge, attitude and adoption and its relationship with selected personal, socio-economic, communication, psychological and situational characteristics of respondents. The present

study was also planned to study the constraints faced by farmers in adoption of bio-fertilizers.

METHODOLOGY

The present study was carried out in Bhandara district of Vidarbha region in Maharashtra State. An exploratory research design of social research was used for the study. From the seven tahsils of Bhandara district nearly one third tahsils i.e. two tahsils were selected purposively on the basis of area under paddy cultivation. Six villages from each selected tehsil were selected with the same criteria. From each selected village 10 farmers were selected randomly who were able to express their views on bio-fertilizers, which comprises total sample of 120 respondents. For collection in data interview structured schedule was prepared by following logical steps. Data here collected by personal interview of respondents. Their responses were considered for the purpose of the study. To study the adoption behaviour of farmers bio-fertilizers and their practices use of in paddy crop was listed out by consultation with the Plant Pathologist of this College. Knowledge and adoption were tested against the practices finalised for the study. Attitude test was developed for the study and responses of selected farmers were noted on five point continuum i.e. strongly agree, agree, undecided, disagree and strongly disagree. After administration of dependent variables index was developed for knowledge, attitude and adoption. Constraints faced by the respondents in adoption of bio-fertilizers were identified and ranked with the help of formula developed for calculations of Rank Based Quotient.

RESULTS AND DISCUSSION

Knowledge of paddy farmers about bio-fertilizers

The knowledge of farmers about various practices connected with use of bio-fertilizers was further ascertained practice wise distribution have been reported in the Table 1

Table 1
Distribution of the respondents according to knowledge adoption of bio-fertilizers in paddy

Sr. No.	Name of bio-fertilizers	Knowledge		Adoption	
		Yes	No	Yes	No
1.	Azotobacter	98 (81.66)	22 (18.34)	91 (75.82)	29 (24.16)
2.	Phosphobacteria (PSB)	105 (87.05)	15 (12.05)	89 (74.16)	31 (25.83)
3.	Blue green algae (BGA)	94 (78.33)	26 (21.67)	92 (76.66)	28 (23.33)
4.	Mycorrhiza	97 (80.84)	23 (19.16)	80 (66.67)	40 (33.33)
5.	Azolla	86 (71.66)	34 (28.33)	97 (80.83)	23 (19.16)
6.	Trichoderma	80 (66.67)	40 (33.33)	63 (52.50)	57 (47.50)
7.	Azospirillum	104 (86.67)	16 (13.33)	89 (74.16)	31 (25.83)

It is observed from Table 1 that, majority of respondents had knowledge about Phosphobacteria (87.05%), Azospirillum (86.67%), Azotobacter (81.66%), Mycorrhiza (80.84%), Blue Green Algae (78.33%), Azolla (71.66%) and Trichoderma (66.67%) respectively. However, 33.33 per cent respondents had no knowledge about Trichoderma, followed by 28.33 per cent respondents had no knowledge about Azolla.

It is observed from Table 1 that, majority of respondents had adoption about Azolla (80.83%), Blue green algae (76.66%), Azotobacter (75.82%), Azospirillum and Phosphobacteria (74.16%), Mycorrhiza (66.67%), Trichoderma (52.50%), respectively. However, 47.50 per cent respondents had no adoption about Trichoderma, followed by 33.33 per cent respondents had no adoption about Mycorrhiza.

Table 2
Distribution of the respondents according to practice wise knowledge and adoption of bio-fertilizers in paddy

Sr. No.	Bio-fertilizers practices	Knowledge			Adoption		
		FK	PK	NK	FA	PA	NA
1.	Application of Azotobacter	66 (55.00)	32 (26.66)	22 (18.33)	56 (46.66)	35 (29.16)	29 (24.16)
2.	Application of Phosphobacteria (PSB)	46 (38.33)	59 (49.16)	15 (12.50)	38 (31.66)	51 (42.50)	31 (25.83)
3.	Application of Blue Green Algae (BGA)	63 (52.50)	31 (25.83)	26 (21.66)	49 (40.83)	43 (35.83)	28 (23.33)
4.	Application of Mycorrhiza	42 (35.00)	55 (45.83)	23 (19.16)	33 (27.50)	47 (39.16)	40 (33.33)
5.	Application of Azolla	51 (42.50)	35 (29.16)	34 (28.33)	39 (32.50)	58 (48.33)	23 (19.16)
6.	Application of Trichoderma	38 (31.66)	42 (35.00)	50 (41.66)	27 (22.50)	33 (27.50)	60 (50.00)
7.	Application of Azospirillum	73 (60.83)	31 (25.83)	16 (13.33)	64 (53.33)	25 (20.83)	31 (25.83)
8.	Recommended dose of Biodecomposer	29 (24.16)	34 (28.33)	57 (47.50)	11 (09.16)	24 (20.00)	85 (70.83)
9.	Storage of bio-fertilizers	48 (40.00)	46 (38.33)	26 (21.66)	28 (23.33)	33 (27.50)	59 (49.17)
10.	Validity of bio-fertilizers	53 (44.16)	37 (30.83)	30 (25.00)	46 (38.33)	51 (42.50)	23 (19.16)

FK- Full knowledge, **PK-** Partial knowledge, **NK-** No knowledge, **FA-** Full adoption, **PA-** Partial adoption, **NA-** No adoption

It is observed from Table 2 that majority of respondents had full and partial knowledge of application of Azospirillum (60.83% and 25.83%), application of Azotobacter (55% and 26.66%), application of BGA (52.50% and 25.83%), validity of bio-fertilizers (44.16% and 30.83%), application of

Azolla (42.50% and 29.16%) and storage of bio-fertilizers (40% and 38.33%), respectively. However 47.50 per cent respondents had no knowledge of recommended dose of bio-decomposer, followed by 41.66 per cent respondents had no knowledge of application of Trichoderma.

From Table 2 it is revealed that most of the respondents had full adoption followed by partial adoption in application of Azospirillum (53.33% and 20.83%) and application of Azotobacter (46.66% and 29.16%) and application of BGA (40.83% and 35.83%), respectively. While majority respondents had partial adoption followed by full adoption of

application of AZolla (48.33% and 32.50%), validity of bio-fertilizers (42.50% and 38.33%), application of PSB (42.50% and 31.66%) and application of Trichoderma (27.50% and 22.50%) respectively. It was also observed that 70.83 per cent respondents never adopted recommended dose of bio-decomposer, because most of them did not have its knowledge.

Table 3
Distribution of the respondents according to their extent of knowledge and adoption of bio-fertilizers in paddy

Sr. No.	Index	Knowledge		Adoption	
		Frequency	Percentage	Frequency	Percentage
1	Low (upto 33)	00	00.00	37	30.83
2	Medium (33.1 to 66.00)	100	83.33	83	69.16
3	High (above 66.00)	20	16.66	00	00.00
	Total	120	100.00	120	100.00
		Mean = 57.91		Mean = 39.56	

Table 3 shows that, vast majority of respondents (83.33%) belonged to medium level of knowledge followed by 16.66 per cent who had occupied the high level of knowledge about bio-fertilizers. There is no respondent found in the low level of knowledge. The average knowledge of respondents was 57.91 per cent. These findings are similar with the findings of Talapeet *al.* (2011), Rahangdaleet *al.* (2011) and Kesharamet *al.* (2015).

From above observations it was concluded that majority of respondents had medium level of knowledge about bio-fertilizers in paddy. The respondents in general were found to be mediocre in possession of knowledge about bio-fertilizers and its related practices. This indicated that, there is a need to improve the knowledge of the farmers about bio-fertilizers and their use.

Table 3 revealed that, majority of respondents *i.e.*, 69.16 per cent belonged to medium level of adoption, followed by 30.83 per cent had the low level of adoption about bio-fertilizers. There are no respondents in the high level of adoption. On an average 39.16 per cent adoption of bio-fertilizer technology was noted in the study area.

It is concluded that, more than half of the respondents (69.16%) belonged to medium level of adoption. It could be inferred that the respondents were mediocre in adoption of bio-fertilizers. Thus, there exists a gap between adoption and knowledge of bio-

fertilizers. There is a wide scope to improve the level of adoption of bio-fertilizers, the findings therefore pointed out that inadequate and sporadic efforts needs to make in popularizing and taking the low cost technology to the door steps of farmers. A concerted effort on the part of extension agency to popularise this technology through various means therefore seems to be appropriate in this direction. The reason for the non adoption of bio-fertilizers could be the lack of specific knowledge about these bio-fertilizers. The farmers should therefore be equipped with detail knowledge about bio-fertilizers. They should be convinced about the effectiveness of bio-fertilizers in crop production through organization of demonstrations and meetings. Further with a view to boost up the adoption of bio-fertilizers it is essential to supply the different bio-fertilizers in time and that too at village level. These findings are similar to the findings of Gawaiet *al.* (2013), Deepthiet *al.* (2014), Rajput and Chinchmalatpure (2016).

Attitude of paddy farmers towards use of bio-fertilizers

Attitude is a predisposition or a tendency to respond positively or negatively towards a certain idea, object and situation. Attitude influences an individual's choice of action and responses to challenges, incentives and rewards. As this study was framed around the attitude of farmers towards use of bio-fertilizers in paddy they are presented in following Tables.

Table 4
Distribution of the respondents according to their attitude about bio-fertilizers in paddy

Sr. No	Statement	SA	A	UD	DA	SDA
1	Use of bio-fertilizers makes soil fertile and productive	26 (21.66)	42 (35.00)	21 (17.50)	18 (15.00)	13 (10.83)
2	The use of bio-fertilizers help in increase the rice yield	33 (27.50)	51 (42.50)	25 (20.83)	07 (05.83)	04 (03.33)
3	Bio-fertilizers helps to grow the plant healthier	40 (33.33)	45 (37.50)	12 (10.00)	18 (15.00)	05 (04.16)

4	Application of bio-fertilizers requires more labour, hence expensive	06 (05.00)	04 (03.33)	27 (22.50)	45 (37.50)	38 (31.66)
5	The use of bio-fertilizers increases the crop produce which fetch the more price in market	00 (00.00)	15 (12.50)	16 (13.33)	54 (45.00)	35 (29.16)
6	Use of bio-fertilizers is more profitable in relation to cost involved	26 (21.66)	49 (40.83)	24 (20.00)	17 (14.16)	04 (03.33)
7	I am not confident that bio-fertilizers will give the expected returns	09 (07.50)	19 (15.83)	05 (04.16)	52 (43.33)	35 (29.16)
8	The use of bio-fertilizers helps to maintains the quality of rice	29 (24.16)	56 (46.66)	21 (17.50)	14 (11.66)	00 (00.00)
9	The paddy treated with bio-fertilizers becomes more resistance to disease	23 (19.16)	61 (50.83)	16 (13.33)	14 (11.66)	06 (05.00)
10	Bio-fertilizer is good, but very difficult to adopt than the chemical fertilizer	00 (00.00)	11 (09.16)	29 (24.16)	48 (40.00)	32 (26.66)
11	The use of bio-fertilizers in rice production helps in better human health benefit	14 (11.66)	26 (21.66)	46 (38.33)	21 (17.50)	13 (10.83)

SA-Strongly agree, A-Agree, UD-Undecided, DA- Disagree, SDA- Strongly disagree

After perusal of Table 4 it is revealed that more proportion of respondents were agreed followed strongly agreed for the attitude statements that the paddy seed treated with bio-fertilizers becomes more resistant to disease (50.83% and 19.67%), the use of bio-fertilizers to maintain the quality of rice (46.66% and 24.16%), use of bio-fertilizers help in increase the rice yield (42.50% and 27.50%), use of bio-fertilizers are more profitable in relation to cost involved (40.83% and 21.67%), bio-fertilizers help to grow plant healthier (37.50% and 33.33%) and use of bio-fertilizers makes soil fertile and productive (35.00% and 21.67%), respectively.

Respondents were also found 'disagree' followed by 'strongly disagree' towards the statements that the use of bio-fertilizers increases the crop produce which fetch the more price in market (45% and 29.16%), respondents were not confident that bio-fertilizers will give the expected returns (43.33% and 29.16%), bio-fertilizer is good but difficult to adopt than the chemical fertilizers (40.00% and 26.67%), and application of bio-fertilizer requires more labour, hence expensive (37.50% and 31.67%), respectively.

Farmers (38.33%) were also found to be undecided about the use of bio-fertilizers in rice production helps in better human health benefits.

Table 5.
Distribution of the respondents according to their levels of attitude towards use of bio-fertilizers in paddy

Sr. No	Attitude	Respondents (n=120)	
		Frequency	Percentage
1.	Less favourable	0	00.00
2.	Moderately favourable	112	93.33
3.	Highly favourable	8	6.66
	Total	120	100.00

The above Table 5 shows that vast majority of respondents (93.33%) had moderately favourable attitude towards agriculture as an occupation, followed by 06.66 per cent respondents had highly favourable attitude towards adoption of bio-fertilizers in paddy.

It could be concluded that attitude of most of the farmers towards bio-fertilizers in paddy is moderately favourable (93.33%) to the adoption of bio-fertilizers in paddy. The reason for moderately favourable attitude may be due to the moderate knowledge of respondents about bio-fertilizers in paddy as seen previously in knowledge level table. There is need to improve the attitude of respondents through guidance and conducting demonstrations of bio-fertilizers

onfarmers' field to show their effectiveness. These findings are similar with the findings of Bhople and Borkar (2002), Gawai *et al.* (2013) and Kesharam *et al.* (2015).

Relational analysis

In order to find out the relationship between selected personal, socio-economic, situational, communicational and psychological characteristics of respondents with adoption behaviour of farmers towards bio-fertilizers in paddy as an occupation was worked out.

The results obtained from relational analysis of knowledge, attitude and adoption has been presented in Table 6.

Table 6
Correlation coefficient of selected characteristics of the respondents with their knowledge, attitude and adoption towards bio-fertilizers in paddy

Sr. No.	Independent Variables	Knowledge	Attitude	Adoption
1.	Age	-0.008	0.0342	0.0109
2.	Education	0.1481	0.0080	0.0251
3.	Land holding	-0.002	0.0672	0.0756
4.	Annual income	0.2234**	0.0905	0.1971*
5.	Experience of farming	0.2371**	0.0747	0.2460**
6.	Availability of bio-fertilizers	0.1762*	0.0500	-0.0489
7.	Training received	-0.0326	0.0189	-0.1147
8.	Extension contact	-0.1296	-0.0481	0.0476
9.	Source of information	0.0936	0.0161	0.1776*
10.	Cosmopolitaness	0.2315**	0.1862*	0.0060
11.	Innovativeness	-0.0075	0.1525	0.1757*
12.	Scientific orientation	0.1793*	-0.1859*	-0.0443
13.	Economic motivation	0.2517**	-0.1928*	0.0717
14.	Risk orientation	0.0600	0.0520	0.1823*

**- Significant at 0.01 level of probability* - Significant at 0.05 level of probability

It is observed from the Table 6 regarding the knowledge, annual income, experience of farming, cosmopolitaness and economic motivation were positively and significantly correlated with knowledge of bio-fertilizer in paddy at 0.01 level of probability while availability of bio-fertilizers and scientific orientation were positively and significantly correlated with knowledge bio-fertilizers in paddy at 0.05 level of probability. In case of age, education, land holding, training received, extension contact, source of information, innovativeness, risk orientation were found non-significant with knowledge of respondents towards bio-fertilizers in paddy. Here null hypothesis is rejected for significant characteristics and accepted for non significant characteristics.

In case of attitude of respondents cosmopolitaness was positively and significantly correlated with attitude of respondents at 0.05 level of probability, while scientific orientation and economic motivation were negatively and significantly correlated with attitude of respondents towards bio-fertilizers in paddy at 0.05 level of probability. Hence the null hypothesis is rejected for these characteristics. Other variables namely age, education, annual income, land holding, experience of farming, availability of bio-fertilizers, training received, extension contact, source of information, innovativeness and risk orientation were non-significant with attitude of respondents towards use of bio-fertilizers in paddy.

Regarding adoption of bio-fertilizers in paddy, annual income and experience of farming were found positively and significantly correlated with adoption behaviour towards bio-fertilizers in paddy at 0.01 level of probability while source of information, innovativeness and risk orientation were positively and significantly correlated with adoption of bio-fertilizers in paddy at 0.05 level of probability. Age, education,

land holding, availability of bio-fertilizers, training received, extension contact, cosmopolitaness, innovativeness, scientific orientation and economic motivation were non-significant with adoption of bio-fertilizers in paddy.

It can be concluded from above results that, the independent variables regarding knowledge of bio-fertilizers in paddy viz. annual income, experience of farming, cosmopolitaness and economic motivation were positively and significantly correlated with adoption behaviour towards bio-fertilizer in paddy at 0.01 level of probability and availability of bio-fertilizers and scientific orientation were positively and significantly correlated with adoption behaviour towards bio-fertilizers in paddy at 0.05 level of probability.

In case of attitude towards adoption behaviour of bio-fertilizers in paddy, cosmopolitaness was positively and significantly correlated with adoption behaviour towards bio-fertilizers in paddy at 0.05 level of probability. Scientific orientation and economic motivation were negatively and significant with adoption behaviour towards bio-fertilizers in paddy at 0.05 level of probability.

In case of adoption of bio-fertilizers in paddy, experience of farming was found positively and significantly correlated with adoption towards bio-fertilizers in paddy at 0.01 level of probability while annual income, source of information, innovativeness and risk orientation were positively and significantly correlated with adoption of bio-fertilizers in paddy at 0.05 level of probability.

Constraints faced by farmers

The constraints faced by respondents' in adoption of agriculture as an occupation were ascertained by researcher. The problems related to

various aspects of perception towards agriculture as an individual respondent. The relevant data in this regard occupation were identified by obtaining response of has been presented in Table 7.

Table 7
Constraints faced by respondents in adoption of bio-fertilizers

Sr. No.	Constraints faced	Frequency(n=120)										RBQ	Rank
		I	II	III	IV	V	VI	VII	VII	IX	X		
1	Lack of confidence in use of bio-fertilizers	45	9	9	6	3	6	9	12	12	9	66.50	II
2	Non availability of bio-fertilizers at local level	18	17	1	6	9	24	9	9	15	12	55.16	IV
3	Lack of timely availability	9	42	3	6	3	6	15	6	9	21	58.25	III
4	Darken the hands and cloths during the use of bio-fertilizers	6	18	15	12	9	6	15	21	6	12	54.75	V
5	Burning of eyes due to use of powder form of bio-fertilizers	3	1	15	3	24	24	33	10	6	1	51.58	VII
6	Doubtful about the quality of bio-fertilizers	1	4	1	15	36	12	9	12	6	24	45.25	IX
7	Lack of training on use of bio-fertilizers	15	16	54	18	3	3	3	5	2	1	76.41	I
8	No timely guidance provided by agriculture department	18	3	12	9	9	15	12	9	24	9	52.25	VI
9	Unawareness about the benefits of bio-fertilizers	3	1	6	27	18	12	6	18	20	9	47.58	VIII
10	Lack of skill in use of different bio-fertilizers	2	9	4	18	12	12	9	18	20	22	42.25	X

From Table 7 It has been revealed that, all the respondents expressed lack of training on use of bio-fertilizers which was found at 1st rank due to its high RBQ (76.41). It was followed by lack of confidence in use of bio-fertilizers (66.50), lack of timely availability (58.25), non-availability of bio-fertilizers at local level (55.16), darken the hands and cloths during the use of bio-fertilizers (54.75), no timely guidance provided by agriculture department (52.25) and burning of eyes due to use of powder form of bio-fertilizers (51.58) and these were ranked at 2nd, 3rd, 4th, 5th, 6th and 7th, respectively.

The unawareness about the benefits of bio-fertilizers (47.58), doubtful about the quality of bio-fertilizers (45.25) and lack of skill in use of different bio-fertilizers (42.25) were the constraints faced by paddy growers, respectively.

These findings are similar to the findings of Bodake *et al.* (2009), Talape *et al.* (2011), Srinivas and Bhalekar (2013) and Rathod *et al.* (2017).

CONCLUSION

It is concluded from the findings that majority of respondents had medium level of knowledge and adoption of bio-fertilizers. There was gap found in the knowledge and adoption of bio-fertilizers by the paddy growers. Major constraints identified regarding this was lack of training, non availability of bio-fertilizers at local level that limits the adoption of bio-fertilizers in paddy, hence the scope was observed to promote the production of bio-fertilizers at local level through entrepreneurship development programme. Also there is need to popularise this low cost technology through campaigns and trainings at village levels.

Received : March 19, 2017

Accepted : November 9, 2017

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