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A captious study on execution of nature friendly practices in vegetables farming among the tribal farmers of Madhya Pradesh

DP Rai, Jagdeesh Morya, SK Badodiya and Govind Bihare

Abstract

The vegetables now become a crucial requisite of the daily human diet, because of its nutritional value. The present investigation was conducted in four tribal district of Madhya Pradesh. Total sixteen villages were selected for the study. There was proportional to total size of the respondents in selected villages fell under each of the four blocks. In all, 240 tribal farmers were selected to serve as the respondents for the study. Mainstream of the farmers (52.50%) were in medium category regarding knowledge about management of eco-friendly practices. Higher percentage (49.17) of the respondents had medium adoption about ecofriendly practices. A preponderance of the farmers 70.84 percent had partially adopted farm yard manure application. Most of the respondents 52.50 and 36.67 percent of the respondents had adopted crop rotation and inter cropping practices in vegetable. Majority of the farmers (75.83%) had not applied any bio-fertilizer for growing vegetables. Higher proportion of the respondents partially adopted the practices like splitting dose of application (60.83%). Massive majority 97.92 percent farmers were found in non-adoption category regarding use of pheromone traps and use of light traps. Hundred percent of the farmers were found in non-adoption category regarding practices such as conservation parasitic wasps. Majority 92.50 percent of the farmers had fully adopted the practices like use of hand weeding in standing crop closely. High cost of improved varieties and new technologies, thus the respondents were unable to acquire those was major constraints reported by 82.50 percent of the respondents. Moreover, 79.16% of respondents' reported lack of awareness about eco-friendly management practices was also a major constraint.

Majority 85.41 percent of the respondents suggested to ensure timely availability of pest resistant improved varieties, followed by three-fourth of respondents said organizing awareness campaign on eco-friendly practices (75.83%).

Keywords: Management, Eco-Friendly Practices, tribal farmers, INM, IPM, parasitic wasps and bio-control agents

Introduction

Vegetables production is the main source of livelihood of the tribes. However, hunter-gatherers or herders are also there. Some tribes are traveling and kept on moving from one place to another. Many large tribes live in forest, hills, deserts, and places difficult to reach. Madhya Pradesh has a total population of 7.25 crore which constitutes about 6 per cent of total population of India, according to the latest 2011 census. Tribes constitute about 20 per cent of the total population of MP. The key environment friendly expertise's merit mentioning are organic farming, traditional farming, natural farming, sustainable farming, bio-dynamic and pharma culture, which can be all collectively considered as eco-friendly farming. Disorganized use of high analysis fertilizers has caused several problems on farm as well as outside farm. Plants become more susceptible to pests and diseases and their control could be effectively done by using high potency poisonous chemicals. As a result, their residue on plants and in the soil had led to health hazards. Similarly, excess nitrogen as nitrate and phosphate leached through the soil and entered natural sources of drinking water also responsible for health hazards.

The chemical detrimental effects of fertilizers in plants are reduction in germination, retardation in seedling growth, scorching and increased susceptibility to diseases. Study within the field of agriculture has recognized variety of environmental friendly technologies like eco-farming, eco-friendly nutrient management. The eco-farming consumes most efficiently the normal practices of crop rotations with legumes, tillage practices to recover soil texture, application of ample organic matter to sustain, maintain and discharge soil moisture, nutrient to match crop requirements and correlation features of soil unhealthiness. There have been hardly any research studies, which have attempted to explore the knowledge of tribal farmers about the environmental hazards and eco-friendly management practices and the status of eco-

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friendly practices followed by farmers with the following objectives-1. To study the level of knowledge and extent of adoption of vegetable growing tribal farmers about eco-friendly management practices. 2. To find out the hindrances within the proper adoption of eco-friendly management and 3. To seek suggestive measure to minimize the ill effect of agro-chemicals as perceived by vegetable growing tribal farmers.

Material and Methods

The present study was conducted in four selected blocks of four districts i.e. Jhabua from Jhabua district, Manawar from Dhar district, Jobat from Alirajpur districts and Rajpur from Badwani districts of Madhya Pradesh, respectively and in these consequences four villages from each of the selected blocks were selected randomly. Thus, in total sixteen villages were selected for the study. A proportionate random sampling process was adopted for the selection of tribal farmers for cultivating vegetable crops. A list of tribal farmers, those who had cultivated vegetable crops for three or more than three years successively, was prepared. A special interview schedule was designed for collecting the data through interview schedule.

The entire schedule was pre-tested in the field with 20 non-sampled respondents were classified to remove irrelevant items which were included in the interview schedule. Based on responses received and experience gained, the necessary modifications were incorporated in the final draft. The data were composed by personal interview technique from randomly selected tribal farmers of the selected districts. The respondents were contacted at their home, community places or their farms.

Results and Discussion

A general and concise sketch of respondents on the root of their level of knowledge about eco-friendly management practices. It refers to information about ecofriendly practices known to respondents. The farmers were categorized on the root of their obtained score of adoption about management of eco-friendly practices.

It refers to information about ecofriendly practices known to respondents. The farmers were categorized on the root of their obtained score of knowledge.

Table 1: Frequency allocation of farmers according to the knowledge about eco-friendly management practices.

| S. No. | Categories | Respondents (n=240) | |
|--------|------------|---------------------|------------|
| | | Frequency | Percentage |
| 1. | Low | 62 | 25.83 |
| 2. | Medium | 126 | 52.50 |
| 3. | High | 52 | 21.67 |
| Total | | 240 | 100.00 |
| Mean | | 1.31 | |
| SD | | 0.81 | |

The statistics in Table 1 and Fig. 1 show that out of the total 240 respondents, the higher percentage 52.50 percent respondents were in the medium knowledge about eco-friendly management practices followed by 25.83 percent respondents had low knowledge about management of eco-friendly practices and only 21.67 percent were in high knowledge about eco-friendly management practices.

The sample means score of knowledge about management of eco-friendly practices of the respondents was found 1.31.

Standard deviation 0.81 was calculated of the quantity of disparity or distribution of a set of ethics of vegetable growing tribal farmers.

Thus, it can be completed that mainstream of the farmers were in medium category regarding knowledge about management of eco-friendly practices. This result reveals in the line of work done by Badodiya *et al.* (2010)^[1]; Patel and Chouhan (2016)^[3] and Maratha & Badodiya (2018)^[2].

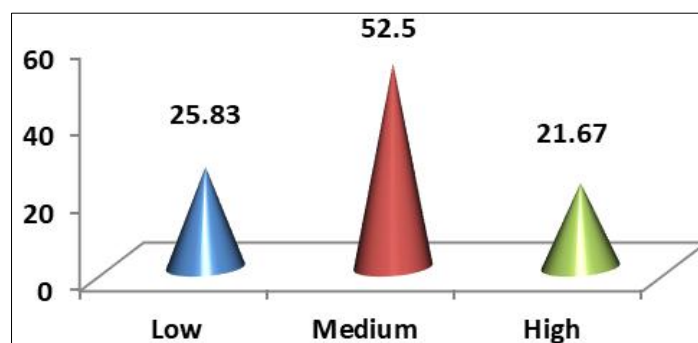


Fig 1: Frequency distribution of respondents according to their knowledge EFPs management practices

Knowledge of eco-friendly management practices by vegetable growing tribal farmers

The examination of statistics offered in Table-2 indicates that hundred percent of the farmers had knowledge about summer season deep ploughing. A vast mainstream of the vegetable growing respondents possessed the knowledge of crop rotation with vegetable crops (82.50%) and seed treatments with chemicals as a control measure of pest (75.00%). About 69.17 and 64.17 percent of the farmers had knowledge about

disease resistance varieties/ hybrids in vegetables and growing pigeon pea/ marigold/ sun hemp as traps and cover crop, respectively. Whereas, 39.17 percent of farmers had knowledge about growing inter crops in vegetables.

Regarding to management of mechanical control, hundred percent of the farmers knew about monitoring of pests and a huge mainstream of the tribal farmers (90.00%) did know about the hand picking of larvae from vegetables. Half of the respondents had knowledge about using of yellow sticky

traps/cards followed by 46.67 percent of the respondents had known about uprooting alternate host plants. About 31.67

percent of respondents had knowledge about light traps, while only 10.00 percent of them had known about pheromone trap.

Table 2: Knowledge about management of eco-friendly practices by vegetable growing respondents-

| S.N. | Practices | Knowledge level | |
|----------|---|-----------------|----------|
| | | Freq. | Per cent |
| 1 | Management of cultural control | | |
| i | Deep ploughing in summer season | 240 | 100 |
| ii | Cultivation of trap and cover crop | 154 | 64.17 |
| iii | Crop rotation with vegetable crops | 198 | 82.50 |
| iv | Intercropping in vegetables | 94 | 39.17 |
| v | Seed treatment | 180 | 75.00 |
| vi | Disease resistant varieties | 166 | 69.17 |
| 2 | Management of mechanical control | | |
| i | Hand pecking of larvae | 216 | 90.00 |
| ii | Observation of pest | 240 | 100 |
| iii | Uprooting alternate host plants | 112 | 46.67 |
| iv | Use of pheromone traps | 24 | 10.00 |
| v | Use of light traps | 76 | 31.67 |
| vi | Use of yellow sticky traps/cards | 120 | 50.00 |
| 3 | Management of biological pest control | | |
| i | Conservation and encouraging of predator | 20 | 8.33 |
| ii | Conservation of parasitic wasps | 14 | 5.83 |
| iii | Use of NPV and concentration of spray | 82 | 34.17 |
| iv | Introduction of bio-control agents | 16 | 6.67 |
| 4 | Management in use of bio-pesticides | | |
| i | Knowledge about neem oil | 34 | 59.17 |
| ii | Preparation of neem oil | 106 | 44.17 |
| iii | Concentration of neem oil | 114 | 47.50 |
| iv | Rate of recurrence of spraying neem oil | 122 | 50.83 |
| 5 | Application of organic manures | | |
| i | Farmyard manure/ green manure/ vermicompost | 240 | 100 |
| ii | Press mud/ seed cake | 116 | 48.33 |
| 6 | Management in use of inorganic fertilizers | | |
| i | Application of recommended dose | 204 | 85.00 |
| ii | Time of application | 224 | 93.33 |
| iii | Method of application | 240 | 100.00 |

In case of management of biological control, 34.17 percent of the vegetable growing respondents know about the utilization of NPV and concentration of spray. Less proportion of the farmers identified about introduction of bio-control agents (6.67%), preservation/conservation and encouraging of predators (8.33%) and conservation of parasitic wasps (5.83%).

More than fifty percent of the farmers possess the knowledge about neem seed kernel extract (59.17%) and frequency of spraying neem seed kernel extract (50.83%), whereas, 47.50 and 44.17 percent of the respondents recognized about concentration of neem seed kernel extract and preparation of neem seed kernel extract, respectively.

The entire cent percent of the farmers had known about application of organic manure like farmyard manure/ green manure/ vermicompost to their field. Further, 48.33 percent farmers know about press mud/seed cake application to vegetables.

With regards to management in use inorganic fertilizers; cent percent of the respondents know about method of application of fertilizers. Whereas, majority of the vegetable growing respondents know that the time of application and recommended dose of fertilizers in vegetables cultivation.

A close assessment of the Table-2 reveals that deep summer season ploughing, observation of pest, application of farmyard manure/ green manure/ vermicompost and method of application were well known to all the farmers. Whereas, mainstream of the farmers know about crop rotation with

vegetable crop, seed treatment with chemicals, hand pecking of larvae, application of suggested dose of fertilizers and time of application. The practice of components which are technical skill orientated are less known to farmers namely pheromone traps, light traps, biological pest control measures, which consists of preservation/conservation and encouraging predators and parasitic wasps, use of NPV and its concentration and introduction of bio-control agents.

It is rational to derive from the above discussion those practices, which are complex and difficult to remember, are least known to farmers, on the other side of the practices which are simple and are being practiced by forefathers are known to most of the farmers. The findings support with the work of Patel & Chouhan (2016)^[3]; Maratha & Badodiya (2018)^[2] and Rajasree *et al.* (2019)^[4].

Adoption of eco-friendly management practices by the respondents–

It refers to information about ecofriendly practices known to respondents. The respondents were categorised on the root of their obtained score of knowledge.

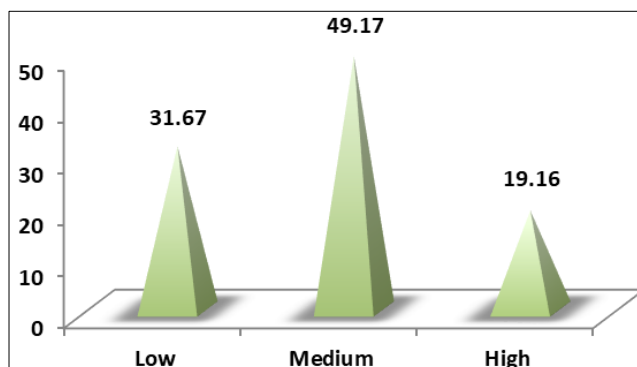
The data showed in Table 3 and Fig.2 show that out of the total 240 respondents, the higher percentage 49.17 percent respondents were in the medium category of adoption about eco friendly practices followed by 31.67 percent were in the low and only 19.16 percent were in high adoption about eco friendly practices.

Table 3: Frequency distribution of farmers according to the adoption eco-friendly management practices.

| S. No. | Categories | Respondents (n=240) | |
|--------|------------|---------------------|------------|
| | | Frequency | Percentage |
| 1. | Low | 76 | 31.67 |
| 2. | Medium | 118 | 49.17 |
| 3. | High | 46 | 19.16 |
| Total | | 240 | 100.00 |
| Mean | | 1.30 | |
| SD | | 0.77 | |

The sample mean of adoption about eco-friendly management practices of the respondents was found 1.31. Standard deviation 0.81 was calculated of the quantity of disproportion or distribution of a set of ethics of vegetable growing tribal

farmers. Thus, it can be accomplished that higher percentage of the respondents had medium adoption about eco friendly practices.

**Fig 2:** Frequency distribution of respondents according to their adoption EFPs management practices

This result reveals in the line of work done by Badodiya, *et al.* (2010)^[1] and Maratha & Badodiya (2018)^[2].

Extent of adoption of integrated nutrient management

(INM) practices by vegetable growing tribal farmers:

The statistics depicted in Table 4 that the adoption of different mechanism of integrated nutrient management practices by the vegetable growing tribal farmers.

Table 4: Extent of adoption of eco-friendly practices (INM) by vegetable growers-

| S.N. | Integrated nutrient management practices | Full adoption | | Partial adoption | | Non adoption | |
|------------|--|---------------|---------|------------------|---------|--------------|---------|
| | | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| I | Utilization of organic manure | | | | | | |
| i | Utilization of farmyard manure (5t/ha) | 70 | 29.16 | 170 | 70.84 | - | - |
| ii | Utilization of green manure (2.5 t/ha) | 20 | 8.33 | 40 | 16.67 | 180 | 75.00 |
| iii | Utilization of poultry manure (2 t/ha) | - | - | - | - | 240 | 100 |
| iv | Utilization of compost (2.5 t/ha) | - | - | - | - | 240 | 100 |
| v | Utilization of vermicompost (2 t/ha) | 24 | 10.00 | 12 | 5.00 | 204 | 85.00 |
| vi | Utilization of seeds cake/ press mud | 12 | 5.00 | 16 | 6.67 | 212 | 88.33 |
| II | Selection of crops and cropping pattern | | | | | | |
| i | Crop rotation with legumes crops | 126 | 52.50 | - | - | 114 | 47.50 |
| ii | Inter cropping | 84 | 35.00 | - | - | 156 | 65.00 |
| iii | Mixed farming | - | - | - | - | 240 | 100 |
| III | Intercultural practices | | | | | | |
| i | Inclusion of crop residues | 40 | 16.67 | 12 | 5.00 | 188 | 78.33 |
| ii | Maintaining of optimum soil moisture to avoid leaching and mobility of nutrients | 12 | 5.00 | - | - | 228 | 95.00 |
| iii | Timely weeding | 90 | 37.50 | 20 | 8.34 | 130 | 54.16 |
| IV | Utilization of natural resources | | | | | | |
| i | Tank silt/ forest litter (leaves) | 36 | 15.00 | 14 | 5.83 | 190 | 79.17 |
| ii | Utilization of rock phosphate | - | - | - | - | 240 | 100 |
| iii | Utilization of gypsum | - | - | 18 | 7.50 | 222 | 92.50 |
| V | Application of bio-fertilizers | | | | | | |
| i | Application of 50% of recommended dose of fertilizers with organic manures | 34 | 14.17 | 24 | 10.00 | 182 | 75.83 |
| VI | Utilization of inorganic fertilizer | | | | | | |
| i | Application of 50% of recommended dose of fertilizers with organic manures | 52 | 21.67 | 100 | 41.67 | 88 | 36.66 |
| ii | Timely application | 60 | 25.00 | 74 | 30.83 | 106 | 44.17 |
| iii | Right method of application | 216 | 90.00 | - | - | 24 | 10.00 |
| iv | Split dose of application | 120 | 50.00 | 102 | 42.50 | 18 | 7.50 |

Utilization of organic manure

A preponderance of the farmers 70.84 percent had partially adopted farm yard manure application. None of them applied poultry manure and compost, while 75.00, 85.00 and 88.33 percent of them never applied green manure, vermicompost and seeds cake and press mud cake in vegetable crops.

No knowledge about potentiality of green leaf manure, poultry manure, compost, vermicompost, also their non-availability and high cost were the main motives for majority of the respondents not adopting the above practices. Hence, extension workers require educating the vegetable growing respondents about the beneficial effects of the green leaf manure, poultry manure, compost and vermicompost by conducting results demonstration on farmer's field.

Management in selection of crops and cropping pattern

The data shows that 52.50 and 36.67 percent of the respondents had adopted crop rotation and inter cropping practices in vegetable. None of the respondents had adopted mixed cropping systems in vegetable. Further, about 65.00 percent of respondents did not practice intercropping. The possible reason might be that vegetables are short duration crops and difficult to undertake intercultural practices. Hence, majority of the vegetable growing respondents had not practiced intercropping with other crops in vegetables.

Management of intercultural practices

The examination of information offered in Table-4 points out that 95.00, 78.33 and 54.16 percent of the respondents never adopted the intercultural practices like maintaining of optimal soil moisture to keep away from the leaching and mobility of nutrients, incorporation of crop dregs and timely weeding, respectively. The non-adoption of intercultural practice like incorporation of crop remains might be due to lack of awareness and knowledge about the benefits of incorporation of crop dregs. The respondents had perceive that burning crop residues compose the field free from pests and diseases and also they perceive that burning crop residues facilitates easy land preparation and inter-cultivation practices for succeeding crop.

Utilization of natural resources

In case of utilization of natural resources, only 15.00 percent of the farmers had fully adopted the practice of using tank silt/ forest litter (leaves) to their land, while, 79.17 percent of them did not apply. In addition to this, cent percent and 92.50 percent of them did not use rock phosphate and gypsum at all. The probable reason might be the non-availability of tank silt and forest litter as the main reason for non-application. Whereas, regarding gypsum it is costly and used only for problematic soils.

Management in application of bio-fertilizer

Majority of the farmers (75.83%) had not applied any bio-fertilizer for growing vegetables (Table 4.22). The possible reason might be lack of knowledge, high cost and their neglect use of bio-fertilizers by the farmers.

Utilization of inorganic manures

In case of utilization of inorganic manures, higher proportion of the respondents partially adopted the practices like splitting dose of application (60.83%) and use of recommended dose of fertilizer (41.67%). While, 90.00 percent of vegetable growing respondents followed for applying right method. About 44.17 percent of vegetable growing respondents did not timely apply inorganic fertilizers. Thus, it is concluded on the basis of above results that mainstream of the respondents not applied recommended dose of fertilizers and timely application whereas, half of the respondents fully adopted of split application of fertilizers on the vegetable crops. Lack of knowledge, high cost of fertilizers might have resulted in such a situation. It is therefore, very necessary for using balance as well as recommended dose of fertilizers and these might be promoted through discussion, training and demonstration, meeting etc. The department of horticulture had to play key role in this regard.

Adoption of integrated management practices (IPM) by vegetable growing tribal farmers

The data portrayed in Table-5 reveals the adoption of eco-friendly management practices by vegetable growing respondents with respect to IPM.

Table 5: Extent of adoption of eco-friendly practices (IPM) by vegetable growers

| S.N. | Integrated pest management practices | Full adoption | | Partial adoption | | Non adoption | |
|------------|--|---------------|---------|------------------|---------|--------------|---------|
| | | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| I | Management of cultural practices | | | | | | |
| i | Deep ploughing in summer | 230 | 95.83 | 10 | 4.17 | - | - |
| ii | Use of pest and disease resistant varieties | 96 | 40.00 | - | - | 144 | 60.00 |
| iii | Seed treatment with bio-fertilizers | 40 | 16.67 | - | - | 200 | 83.33 |
| iv | Crop rotation | 230 | 95.83 | - | - | 10 | 4.17 |
| v | Trap cropping | 28 | 11.67 | 22 | 9.17 | 190 | 79.16 |
| vi | Inter cropping | 34 | 14.17 | - | - | 206 | 85.83 |
| vii | Installation of bird perches for predatory birds | - | - | - | - | 240 | 100 |
| II | Management of mechanical practices | | | | | | |
| i | Uprooting alternate host plant | 106 | 44.17 | - | - | 134 | 55.83 |
| ii | Monitoring of pests | - | - | 100 | 41.67 | 140 | 58.33 |
| iii | Collection and destruction of affected plant parts | 48 | 20.00 | 96 | 40.00 | 96 | 40.00 |
| iv | Use of pheromone trap | 5 | 02.08 | - | - | 235 | 97.92 |
| Vi | Use of light traps to attract nocturnal insect and pests | 5 | 02.08 | - | - | 235 | 97.92 |
| Vi | Use of yellow sticky traps/cards | 15 | 06.25 | 5 | 02.08 | 220 | 91.67 |
| III | Management of biological pest control | | | | | | |
| i | Conservation and encouraging of predators in the field | 5 | 2.08 | - | - | 235 | 97.92 |
| ii | Conservation of parasitic wasps | - | - | - | - | 240 | 100 |
| iii | Introduction of bio-control agent | 4 | 01.67 | - | - | 236 | 98.33 |
| IV | Management in use of bio-pesticides | | | | | | |
| i | Use of neem seed kernel extract for worms and white fly | 18 | 7.50 | 82 | 34.17 | 140 | 58.33 |

| | | | | | | | |
|----------|---|-----|-------|-----|-------|-----|-------|
| ii | Use of neem cake/bar to control nematodes/ root disease | 10 | 4.17 | 40 | 16.67 | 190 | 79.17 |
| iii | Ash/ cow dung slurry for control of pests and diseases | 36 | 15.00 | 46 | 19.17 | 158 | 65.83 |
| iv | Application of ash | 22 | 9.17 | 54 | 22.50 | 164 | 68.33 |
| V | Management of weed practices | | | | | | |
| i | Keeping field bunds free from weeds | 220 | 91.66 | 10 | 4.17 | 10 | 4.17 |
| ii | Timely inter-cultivation | 76 | 31.67 | 128 | 53.33 | 36 | 15.00 |
| iii | Hand weeding | 222 | 92.50 | - | - | 18 | 07.50 |
| iv | Bio-herbicides | - | - | 16 | 6.67 | 224 | 93.33 |

Management of cultural practices

In case of management of cultural practices, a huge majority 95.83 percent of the vegetable growing respondents adopted deep ploughing in summer which is a significant method of revealing the early stages of insect and pest to sun for natural annihilation and making the soil to a fine tilth for escalating the soil fertility and for superior germination of seeds. Crop rotation in vegetable was also followed by 95.83 percent of the farmers.

In assumption of practices such as, use of pest and anti disease varieties, seed treatment with bio-fertilizers, trap cropping, use of intercropping and installation of bird perches for predatory birds, 60.00, 83.33, 79.16, 85.83 and 100.00 percent of the respondents, respectively were found in non adoption category. Effortless availability of urea and other nitrogenous fertilizers performed as obstruction switching over to the use of bio-fertilizers.

Management of mechanical practices

Regarding management of mechanical practices; about 44.17 percent of respondents fully adopted the practices like uprooting, alternate host plants, while, 41.67 and 40.00 percent of them were found in partially adoption category in case of monitoring of pests and collection and destruction of affected plant parts and shoots, respectively.

Massive majority 97.92 percent farmers were found in non-adoption category regarding use of pheromone traps and use of light traps whereas, 91.67 percent of the farmers never used the yellow sticky traps in their fields. This might be because, the use and maintenance of pheromone and light traps required good care on the part of the farmers, required periodical replacement of the lure and their non availability. Furthermore, 58.33 and 55.83 percent of respondents were also found to be in non-adoption category regarding monitoring of pests and uprooting alternate host plants, respectively.

Management of biological control

Regarding management of biological control; hundred percent of the farmers were found in non adoption category regarding practices such as conservation parasitic wasps followed by 97.92 percent of the respondents had conserved and encouraging predators, whereas, only 01.67 percent respondents had introduced of bio-control agents. This might be due to farmers' resorted to indiscriminate use of insecticides for immediate and effective control. The farmers had lack of technological skill in managing and using them in preservation of natural rivals. Moreover, the farmers might not have influenced about this practice due to unhurried impact on control of pests and intangible nature.

Management in use of bio-pesticides

On the assumption of management of bio-pesticides, mainstream of the farmers were found in non adoption

category regarding use of neem seed kernel extract for worms and white flies (58.33%), use of neem cake/bar to control nematodes/ root diseases (79.16%), use of cow dung slurry (65.83%) and application of ash (68.33%). It is noticeable that the bio-control procedures are the pioneering practices and vegetable producing respondents might lack of the scientific awareness about their use. Additionally, non-availability of bio-control agents might be the possible reason behind low acceptance of bio-pesticides.

The most probable reason for non-adoption of ash and cow dung could be emphasized to its non-technical and unscientific way of pest control, which lacked to evince interest in farmers.

Management of weed practices

It is pragmatic that vast majority 92.50 percent of the farmers had fully adopted the practices like use of hand weeding in standing crop closely followed by keeping bunds free from weeds (91.66%). Normally weeding procedure was assumed by the vegetable producing farmers for which hand hoes were used. These were miniature and uncomplicated to grip by the women labours. Further, 53.33 percent of farmers were found to have partial adoption of timely inter cultivation practices. Majority 93.33 percent of the respondents were not used the bio-herbicides for controlling the weeds.

The results support with the effort of Maratha & Badodiya (2018) [2] and Rajasree *et al.* (2019) [4].

Hindrances in the proper adoption of environment friendly management practices

The results in Table-6 explain that the vegetable growing respondents faced several constraints, limitations and restrictions in adopting the eco friendly management practices. High cost of improved varieties and new technologies, thus the respondents were unable to acquire those was major constraints reported by 82.50 percent of the respondents & it's got ranked I. Inadequate marketing tendencies and strategies prevented them from adopting the practices and it's got ranked III (70.83% of respondents). Moreover lack of awareness about eco-friendly management practices got ranked II (79.16% of respondents) along with less financial support and industrial/technical support by the government was experienced by the 64.16 percent of vegetable growing respondents & got ranked IV. Almost half of the respondents (49.50%) reported lack of knowledge about the atmosphere and climate regarding issues with stands on ranked V, less participation of the farmers in to the extension programmes was also a critical constraints reported by the respondents and got ranked VI (42.50% of respondents) and derisory environmental education at the school level at ranked VII (32.91% of respondents) also hindered the adoption of eco friendly management practices by the vegetable growing respondents.

Table 6: Hindrances in the proper adoption and management of environment friendly practices.

| S. N. | Constraints faced by vegetable growing respondents | Freq. | % | Rank |
|-------|--|-------|-------|------|
| 1. | High cost of improved varieties and new technologies | 198 | 82.50 | I |
| 2. | Inadequate marketing tendencies and strategies | 170 | 70.83 | III |
| 3. | Lack of awareness about eco-friendly management practices | 190 | 79.16 | II |
| 4. | No subsidy and industrial/technical support provided by the government | 154 | 64.16 | IV |
| 5. | Lack of knowledge about the atmosphere and climate regarding issues | 119 | 49.50 | V |
| 6. | Less participation of the farmers to the extension programmes | 102 | 42.50 | VI |
| 7. | Derisory environmental education at the school level | 79 | 32.91 | VII |

Measures for minimizing the ill effects and properties of agrochemicals:

It has been experimented in the Table-7 that the majority 85.41 percent of the respondents suggested to ensure timely availability of pest resistant improved varieties, followed by three-fourth of respondents said organizing awareness campaign on eco-friendly practices (75.83%). Nearly two-third of respondents suggested heartening farmers to cultivate

organic vegetables through subsidies, technical support etc. (70.83%) and ensure quality control measures for pesticides (65.83%).

Encourage the use bio-pesticides and bio-fertilizers must be increased was suggested by 54.17 percent of the respondents. Nearly fifty percent of the respondents suggested about promotion and use of bio-control agents in control of pest must be increased (49.17%).

Table 7: Measures for minimizing the ill effects and properties of agrochemicals.

| S. N. | Suggestions made | Frequency | Percent |
|-------|--|-----------|---------|
| 1 | Ensure timely availability of pest resistant improved varieties | 205 | 85.41 |
| 2 | Organize awareness campaign on eco-friendly practices | 182 | 75.83 |
| 3 | Encouraging farmers to cultivate organic farming | 170 | 70.83 |
| 4 | Ensure firm quality control measures for pesticides | 158 | 65.83 |
| 5 | Encourage bio-pesticides and bio-fertilizers must be increases | 130 | 54.17 |
| 6 | Promote bio-control agents in control of pests must be increased | 119 | 49.50 |
| 7 | Give premium price for organically growing vegetables | 84 | 35.00 |
| 8 | Educate and create awareness among public and farmers about the environmental issues | 112 | 46.67 |
| 9 | Establishing a network of farmers adopting organic farming | 74 | 31.66 |
| 10 | Introducing ecological education at the school level | 82 | 34.16 |

Out of 240 respondents 46.67 percent of the respondents advocated educating and creating the awareness among public and farmers about environmental issues. Thirty five per cent farmers suggested about giving premium price for organically grown vegetables. Introduction of ecological education at school level and establishing a network of farmers adopting organic farming was suggested by 34.16 per cent and 31.66 per cent, respectively.

Conclusion

Vegetables are an important part of our daily diet and tribal are also eager to cultivation of vegetables. Majority of the farmers were in medium category regarding knowledge about management of eco-friendly practices. Higher percentage (49.17) of the respondents had medium adoption about eco friendly practices. A preponderance of the farmers 70.84 percent had partially adopted farm yard manure application. Most of the respondents 52.50 and 36.67 percent of the respondents had adopted crop rotation and inter cropping practices in vegetable. Majority of the farmers (75.83%) had not applied any bio-fertilizer for growing vegetables. higher proportion of the respondents partially adopted the practices like splitting dose of application (60.83%). Massive majority 97.92 percent farmers were found in non-adoption category regarding use of pheromone traps and use of light traps. Hundred percent of the farmers were found in non adoption category regarding practices such as conservation parasitic wasps. Majority 92.50 percent of the farmers had fully adopted the practices like use of hand weeding in standing crop closely. High cost of improved varieties and new technologies, thus the respondents were unable to acquire those was major constraints reported by 82.50 percent of the

respondents. Moreover, 79.16% of respondents' reported lack of awareness about eco-friendly management practices was also a major constraint. Majority 85.41 percent of the respondents suggested to ensure timely availability of pest resistant improved varieties, followed by three-fourth of respondents said organizing awareness campaign on eco-friendly practices (75.83%).

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