Original Research Article

ASSESSMENT OF SAFE VEGETABLE CULTIVATION AT JASHORE IN BANGLADESH: EVIDENCE FROM COUNTRY BEAN, CUCUMBER AND POINTED GOURD CULTIVATION

Abstract

The study was designed to assess the present status and methods of safe vegetable production at farm level in selected areas of Jashore during January-May, 2023. For the study ninety sample farmer were selected by stratified sampling from three sub-district of Jashore. Average farm size was 0.79 ha in study area. Farmer doing different agronomic management such as weeding, irrigation, spraying, de-topping, stalking, earthing up etc. Farmer used different methods simultaneously such as insecticide spray, bio-pesticide, sex pheromone, yellow trap, white trap, hand picking etc. for controlling insect pest. About sixty-four percent farmer sprayed synthetic pesticide and rest of them used bio control method such as bio-pesticide (bio-chamak, eco-mac, bio-envir, bio-cin), sex pheromone trap, yellow trap and hand picking for control insect pest in their fields. About fifty-eight percent farmer used bio-fertilizer along with organic fertilizer (manure, vermin compost) and seventy-eight percent farmer used chemical fertilizer for vegetable cultivation. Total production cost of country bean was Tk.3,36,579 ha^{-1}, cucumber was Tk.3,25,915 ha^{-1} and pointed gourd was Tk.4,40,106 ha^{-1}. Among the cost item labor cost was highest. Average yield of country bean was 30.60 tha^{-1}, cucumber was 30.08 tha^{-1} and pointed gourd was 41.60 tha^{-1}. Highest benefit cost ratio was cucumber (2.13) followed by pointed gourd (2.07) and country bean (1.50),that means safe vegetable cultivation also profitable. Farmer awareness, havoc attack of pest and insect were the main problem for safe vegetable cultivation. Market facilities, demand, value chain, proper price for organic vegetable, and farmer motivation can promote and enhance safe vegetable cultivation.

Keywords: Safe vegetable, organic cultivation, country bean, cucumber, pointed gourd, bio-pesticide

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1. Introduction

Bangladesh is primarily an agro based country, where forty percent labor forced engaged in agriculture sector (BER, 2022). Agriculture plays a vital role in economic development in terms of food safety, food security, nutrition, value addition, export earnings, and employment. Weather and soils of Bangladesh are suitable for various crop cultivation. About more than 100 vegetables out of more than 500 varieties were grown worldwide. Bangladesh has achieved third position in terms of vegetable production behind China and India (FAO, 2017). Various types of

vegetables are grown in Bangladesh for own consumption and commercial purpose which area is increasing day by day (Khatun *et al.,* 2022). Bangladesh is a pioneering country in South Asia for vegetable production (Khan *et al.,* 2022) and its annual vegetables production was 4.58 million tons (BBS,2023) during 2020-21. Different varieties of vegetables are being produced in the country which categories summer, winter, and year round vegetables (Hasan *et al*.,2020; Hajong *et al*.,2022; Mustafiz *et al*., 2021).

The major winter vegetables are cauliflower, cabbage, tomato, carrot, radish, spinach, brinjal, bottle gourd, sweet gourd, beans, and potato. The major summer vegetables are okra, pointed gourd, summer tomato, summer brinjal, summer beans, ribbed gourd, teasel gourd, ash gourd, red amaranth, kangkong, Indian spinach, cucumber and bitter gourd. Many vegetables among these are cultivated year round now a days such as bean, brinjal, tomato, sweet gourd, bottle gourd, green banana etc. In Bangladesh summer vegetable 1.27% of total cultivated area and winter vegetable 1.38% area are covered (BBS,2023). According to WHO/FAO, daily requirements of fruits and vegetable for Bangladesh are 400g per person (Mustafa *et al*., 2021) but available intake is167.3g vegetable and 35.8g fruits per day per capita which is meager amount and has scope to increase (HIES,2019). Vegetables are the cheapest source of vitamins, minerals, salts and proteins, which are essential elements for human health and balanced diet (Hajong *et al*., 2020).

Vegetable farming generate employment, poverty alleviation, food security, enhance standard of living by increasing income level of rural population, and decreasing malnutrition (Hajong *et al.,* 2018). It is important both from nutritional and financial point of view, which provide opportunities for economic empowerment, household food security, access to nutrition round the year, and conservation of the natural environment (Kuddus *et al.,* 2021). Vegetable cultivation is taking place in vast fields, around homestead garden, along rural roads, in roof gardens, in haors, coastal areas, gher dyke and in floating seedbeds in low-lying areas of the south-west(Hajong *et al*., 2021). More than two crore farmers involved directly or indirectly in agricultural farming throughout the country in production of these vegetables.

Vegetables are being exported from Bangladesh to more than 50 countries around the world, especially to the South Asian sub-continent and Gulf region (Karim *et al*., 2011). For catch up foreign exchanges by exporting vegetables, farmers need to produce non-toxic safe vegetables by following standard cultivation procedure such as Good Agricultural Practices (GAP). In Bangladesh safe food and safe vegetable demand is increasing day by day. So, there is an ample opportunity to grow more safe vegetables (Rokonuzzaman *et al*., 2019). Besides, the government has also given emphasize on the produce and sale of safe agricultural products in the market by fixing the cost of production as safe vegetable production is costly.

Consequently, consumers always prefer safe and pesticides-free organic foods because of those products are healthier and environment friendly (Hasan *et al*., 2020; Parveen *et al*., 2023). Safe vegetable cultivation was farming system practiced by organic cultivation (organic fertilizer, bio-pesticide, IPM etc.) along with chemical fertilizer and synthetic pesticide in judicious used by the farmer. Safe vegetable cultivation farmer cultivated vegetable in safe and organic way with

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manure, vermi compost, bio fertilizer for plant nutrient supply instead of chemical fertilizer. For controlling insect and pest, farmer used bio pesticide such as bio-chamak, eco-mac, bio-envir, bio-cin etc., used IPM technology along with different insect trap such as yellow trap, white trap, sex pheromone etc. But because of using pesticides in vegetable cultivation indiscriminately, consumers are concerned of those about chemical residues and microbial contamination of food (Hasan *et al*., 2020). Due to lack of awareness and knowledge of using pesticides safely, it is difficult to get safe vegetable in the market. For this reason, this study is taken for the following objectives. i)To know the present status and methods of safe cultivation of country bean, cucumber and pointed gourd; and ii) To determine the problem and prospect of safe vegetable cultivation.

2. METHODOLOGY

2.1.Study areas and sample size

For present study a total of 90 farmers from three sub-district of Jashore region namely Jashore sadar, Bagharpara and Kaligonj were purposively selected for data collection during January-May, 2023. Thirty samples from each sub-district were selected by stratified sampling for the present study where safe vegetable cultivation were practiced. Data was collected from each farmer by the prepared questionnaire and descriptive and statistical method of analysis was followed. The study was carried out by using formal survey method with prepared questionnaire. In this questions it included socio economic data, farm type, vegetable cultivation data, IPM (Integrated Pest Management) practice, input use, cost of input and output price and problem identify etc. The questionnaire was prepared in Bengali and face to face interview was done in Bengali for close interaction with farmer. For cross section of information farmer were gathered in one place and interview were taken together and individually. The primary data was collected based on field survey from farmers who are involved in safe vegetable cultivation. Necessary information regarding the study was collected based on socio economic characteristics of the farmers, safe vegetable cultivation of some vegetable such as country bean, cucumber and pointed gourd etc. Field investigators under the direct supervision of the researcher collected field level data. The unit of data collection was taken and analysis was done on per hectare basis. By analyzing data, a combination of descriptive statistics, mathematical and statistical techniques were used to achieve the objectives and to get the meaningful results.

2.2.Descriptive statistics and Profitability analysis of major crops

Collected data were edited, summarized, tabulated and analyzed to fulfill the objectives of the study. Descriptive statistics using different statistical tools like averages, percentages and ratios were used in presenting the results of the study was calculated simple Microsoft excel. Mean, range, maximum value, minimum value, Standard Deviation (SD) etc. were calculated by the statistical packages of SPSS (Statistical Packages for Social Science). Graphical data presentation such as graphs and figures were presenting by the output results.

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Profitability analysis of vegetable cultivation was measured in terms of gross return, gross margin, net return and benefit cost ratio (undiscounted). The formulas which required for the calculation of profitability were discussed as follows (Dillon and Hardaker, 1993):

GR =∑ Pij × ∑Qij; GM = ∑GR – ∑TVC; NR = GR – ∑(TFC + TVC) ;
BCR = GR ÷ (TFC + TVC)
Where, GR = Gross Return;
Pij = Sales price of i vegetable of j farmer ($Tk.ha^{-1}$);
Qij = Yield of i vegetable of j farmer ($Tonha^{-1}$);
GM = Gross Margin;
TVC = Total Variable Cost ($Tk.ha^{-1}$) ;
NR = Net Return; TFC = Total Fixed Cost (Tk.); and BCR = Benefit Cost Ratio
Problem on safe vegetable cultivation was analyzed by using 5-point Likert scale (Rensis Likert), where 5 was Extremely Problem (EP), 4 was Very Problem (VP), 3 was Moderately (M), 2 was Slightly (S) and 1 was Not At All (NAA). Total Weighted Score (TWS) and Weighted Average Score (WAS) for each selected response were calculated using the following formula:
Total Weighted Score (TWS) = 5*EP+ 4* VP+ 3*M+ 2*S+1*NAA (Eq.1)
Weighted Average Score (WAS) = Total Weighted Score / Total number of respondents (Eq.2)
Where, EP, VP, M, S and NAA denotes "extremely problem", "very problem", "moderately", "slightly" and "not at all problem" respectively for the statement.

3. Results and Discussion

Socioeconomic status, economic profitability and use of pesticide on vegetable production were discussed below:

3.1.Socioeconomic profile of the respondent farmers

Socioeconomic profile of the respondent farmers is required to have an idea about the present farm activities, possible development opportunities and potentials for more efficient farming. Therefore, information regarding respondents age, education, occupation, family size, farm size, land use pattern, training and experience in cultivation were recorded for the study. Major farmers of the study areas were experienced farmer and they works in their farm by inheritance. About sixty one percent farmers were young age as they could work in their fields and had knowledge about the modern farming technology and adopted new technology easily. Besides that being literacy knowledge farmers getting training from different research organization and government agencies they could knew about the new technology and adopted them. About fifty-eight percent farmer getting training on IPM technology and safe vegetable cultivation. Most of the farmer's main occupation was farming and very few was engaged in business besides farming.

Table 1: Socioeconomic profile of the respondent farmers in the study areas

Attributes	Categories	% of farmer	Range	Mean	S.D
Age (Year)	>30 years	13.33	18-70	43.69	12.18

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	31-50	61.11			
	>51 years	25.56			
Level of education (Year of schooling)	Literacy knowledge	23.33	1-15	7.00	4.36
	Primary	26.67			
	SSC	31.11			
	HSC and above	18.89			
Family size (No.)	Male	40.30	2-15	6.00	2.55
	Female	33.27			
	Children	26.43			
Main occupation	Agriculture	93.33			
	Agriculture and business	6.67			
Farming experience	year	19.08	2-45	19.08	11.08

Source: Field data, 2023.

3.2.Land use pattern

Most of the farmer has their own land more or less and some other farmer cultivate land by lease from other or mortgage from other farmer. Average farm size was 0.79 ha which ranges 0.08-2.79ha (Table 2). Farmer had their own cultivated land for farming and some portion was used for vegetable cultivation which land was high to medium high land. Those farmers had not their cultivable land they cultivated others land taking by lease with fixed amount of rent for a year and that was vary from land to land and location to location. Lease amount was varying Tk.90,000-1,50,000 per hectare from location to location and land type. Some farmer took mortgage for cultivation land for a fix amount for money but not time limit. Mortgage amount was varying Tk.12,00,000-15,00,000 per hectare which was vary by location to location and land type.

Table 2: Land use pattern of the farmers (ha)

Land use pattern	Range	Mean	S.D
Average farm size	0.08-2.79	0.79	0.42
Own cultivated land	0.03-2.79	0.45	0.49
Mortgage in cultivated land	0.06-0.67	0.13	0.13
Lease in cultivated land	0.08-1.05	0.21	0.21
Vegetable cultivated area	0.05-0.65	0.18	0.11

Source: Field data, 2023.

3.3.Agronomy management

Farmer whose cultivated vegetable in their fields was planting in line by prepared bed in fields after well prepared of land. Among the cultivated variety about seventy six percent was collected from locally as they produced and collected previously. They kept their seed and seedling/vine for their own used and some one collected from neighbor farmer for his required seed. Only

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thirty four percent farmer cultivated hybrid seed which bought from local seed dealer. Farmer irrigated their field shallow pump and some one at deep irrigation pump from own and some one from other by hiring at hour basis. Irrigation was necessary for vegetable cultivation at dry season and it affect on yield performance (Kobir *et al*., 2019). They inundate their fields at a time when required irrigation or water of their fields. Farmer weeding by hands several times whenever weed was spread throughout the fields. Other agronomic management done by the farmer was de-topping, stalking, earthing up etc. It was reported that in some cases de-topping increases yield of crop (Kobir *et al*., 2021).Farmer remove dead leaves and branches to kept the fields neat and clean for controlling insect pest of their fields. Wherever required farmer doing earthing up the soil to covered root zone. Organic fertilizer as well as some chemical fertilizer were applied and mixing up the soil when land was prepared and bed was prepared for seed sowing and vine planting. In other case fertilizer was applied for top dress in time to time after irrigation and weeding at morning whenever required.

Table 3: Agronomic management of crop production

Particular	Attributes	% of respondents
Variety used	Local	75.56
	Hybrid	24.44
Seed/vine planting	Line	100.00
Seed/vine source	Own	65.56
	Bought	34.44
Source of water	Irrigated	100.00
Source of irrigation	Sallow machine	100.00
Methods of irrigation	Inundate fields	100.00
Weeding	By hands	100.00
Other agronomic management	De-topping	100.00
	Stalking	100.00
	Earthing up	100.00

3.4.Crop protection management

Farmer used different methods for controlling insect pest and farmer used combined method for pest control at a time. For any vegetable cultivation insect pest attack was severe for production and farmer spend huge amount of expenditure in this item (Hajong *et al*., 2018). About sixty-four percent farmer sprayed synthetic pesticide, which was less than conventional farmer where ninety-nine percent farmer spray pesticide (Chowdhury *et al*., 2019; Hajong *et al*.,2020). Rest of the farmer used bio control method such as bio-pesticide, sex pheromone trap, yellow trap and hand picking for controlling insect pest in their fields (Table 4). About fifty-eight percent farmer used bio-fertilizer for vegetable cultivation. About seventy-eight percent farmer used chemical fertilizer for vegetable cultivation which used conventionally and it reported that fertilizer application increases crop yield significantly (Mondal *et al.,* 2016).Yellow trap was becoming more popular among the farmer as they argued that it was more effective than other biological

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control method of insect control. First spray of pesticide was done before flowering at vegetative stage of any crops. Some farmer was used herbicide for controlling weed but most of the them did not used herbicide that they did weeding by hands and that of weed was used for cattle fodder. Farmer used some herbicide such as panida, prime axim, etc. for controlling weed at vegetative stage one or two times in a season. Farmer used bio pesticide such as bio-chamak, eco-mac, bio-envir, bio-cin etc. at their fields for controlling insect pest several times along with sex pheromone and yellow trap.

Table 4: Crop protection technology adoption (percentage of farmer)

Particular	Attributes	% of respondents
Bio-fertilizer apply	Yes used	57.78
Chemical fertilizer apply	Yes applied	77.78
Insect control method used	Insecticide spray	64.44
	Bio-pesticide used	37.78
	Sex pheromone trap used	50.00
	Yellow trap used	96.67
	Hand picking	100.00
Spray schedule	Morning	44.44
	Evening	55.56
First spray apply	Vegetative stage	100.00
Herbicide used for weed control	Used	33.33
Repellent crop used for insect control	Used	22.22
Knowledge on insect and disease attack		100.00

3.5.Training and post harvest method for safe vegetable cultivation

Training improves experience and aware among the farmer about the safe vegetable cultivation. Farmer who got proper training on IPM technology and safe vegetable cultivation from different organization they were advance from other farmer and aware about safe vegetable cultivation. About fifty-eight percent farmer got training on vegetable cultivation and among them fifty-one percent farmer got training on Integrated Pest Management (IPM) and safe vegetable cultivation (Table 5). Those who got training on safe vegetable cultivation they motivated and cultivating safe vegetable and also motivated to others farmer. Training increase farmers' efficiency (Hasan *et al*., 2020), which increase productivity. Farmer received training from Department of Agriculture Extension (DAE), research organization such as Bangladesh Agricultural Research Institute (BARI), different NGO (Non Government Organization) and company on farming activities. Maximum farmer harvested vegetable at morning for sold at local market and sometimes at evening. They harvested vegetable by their hands though some farmer used scissors for picking up vegetable, but normally done by hands and when it was marketable size. It was reported that training, education, knowledge and farmer income changed the farmer attitude (Iqbal *et al*., 2014).

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Table 5: Training and post harvest related information

Particular	Attributes	% of respondents
Training on vegetable production	Get training	57.78
	No training	42.22
Training on IPM and safe vegetable cultivation	Get training	51.11
	No training	48.89
Training received	DAE	65.22
	Research(BARI)	95.65
	NGO/company	15.22
Harvesting time of vegetable	Morning	80.00
	Evening	60.00
Harvesting method	Hand picking	100.00
Harvesting stage	Full maturity (shape and color)	100.00

3.6.Cost of vegetable cultivation

Total production cost of country bean was Tk.3,36,579ha^{-1}, where variable cost was Tk.2,07,742ha^{-1}(61.72%) and fixed cost was Tk.1,28,837ha^{-1}(38.28%) (Table 6). Total production cost of cucumber was Tk.3,25,915ha^{-1}, where variable cost was Tk.2,01,557ha^{-1}(61.84%) and fixed cost was Tk.1,24,358ha^{-1}(38.16%). Total production cost of pointed gourd was Tk.4,40,106ha^{-1}, where variable cost was Tk.3,06,714ha^{-1}(69.69%) and fixed cost was Tk.1,33,391ha^{-1}(30.31%). Among the cost item labor cost was highest. Most of the farmer worked in their fields along with his family member which wages or cost did not count by the farmer. But if they hired labor from others than they need to pay wages for that works. Farmer with his family member done land preparation, bed preparation, seed sowing, vine planting, fertilizer applying, spraying, weeding, irrigating, harvesting etc. In some cases, farmer hired labor to help his work by wages specially in case of bed preparation, weeding, trellis preparation, harvesting etc. for daily basis at morning. Trellis preparation cost of any vegetable cultivation had significant effect on production cost (Hajong *et al*., 2018). Most of the farmer had their own seed and also collect pointed gourd vine from his neighbor farmer but in this case it consider market value of seed and vine that they sowing and transplanting their fields. Farmer who practices safe vegetable cultivation they used organic fertilizer more than chemical fertilizer. In a study it was reported that chemical fertilizer cost had maximum share on production cost than organic fertilizer (Hajong *et al.,* 2023; Rahman and Hajong, 2022). In this case safe vegetable cultivation farmer used different types of organic fertilizer such as manure, vermi composting, bio-fertilizer etc. Chemical pesticide was used besides biological control trap.

Table 6: Per hectare production cost of some vegetable cultivation

Cost item	Country bean		Cucumber		Pointed gourd	
	Cost (Tk./ha)	% of cost	Cost (Tk./ha)	% of cost	Cost (Tk./ha)	% of cost

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Variable costs						
Land preparation	18011	5.35	16909	5.19	12625	2.87
Seed/ vine	2955	0.88	3272	1.00	10063	2.29
Hired labour	59534	17.69	36537	11.21	53009	12.04
Chemical fertilizer	7601	2.26	23727	7.28	57879	13.15
Organic fertilizer	22580	6.71	31069	9.53	32149	7.30
Pesticide	28545	8.48	14200	4.36	27718	6.30
Biological control trap	13504	4.01	11434	3.51	12113	2.75
Irrigation	10551	3.13	24071	7.39	30780	6.99
Trellis and netting	35515	10.55	31659	9.71	57170	12.99
IOC @6%	8946	2.66	8680	2.66	13208	3.00
Total variable cost	207742	61.72	201557	61.84	306714	69.69
Fixed cost						
Land use cost	56100	16.67	56100	17.21	56100	12.75
Family labour	72737	21.61	68258	20.94	77291	17.56
Total fixed cost	128837	38.28	124358	38.16	133391	30.31
Total cost	336579	100.00	325915	100.00	440106	100.00

Source: Authors calculation

Note: IOC means Interest on Operating Capital.

3.7.Returns from vegetable cultivation

Average yield of country bean was 30.60 tha^{-1}, cucumber was 30.08 tha^{-1} and pointed gourd was 41.60 tha^{-1}(Table 7). Gross return of country bean was Tk.5,03,915 ha^{-1} and net return was Tk. 1,67,336ha^{-1}. Gross return of cucumber was Tk.6,94,440 ha^{-1} and net return was Tk. 3,68,525 ha^{-1}. Gross return of pointed gourd was Tk.9,12,674ha^{-1} and net return was Tk. 4,72,568 ha^{-1}. Highest Benefit Cost Ratio (BCR) was cucumber (2.13) followed by pointed gourd (2.07) and country bean (1.50). In a study it showed that, IPM based cultivation was profitable than conventional vegetable cultivation (Akter *et al*., 2016).

Table 7: Per hectare profitability of vegetable cultivation

Particulars	Country bean	Cucumber	Pointed gourd
Yield (tha^{-1})	30.60	30.08	41.60
Gross return ($Tk.ha^{-1}$)	503915	694440	912674
Total cost ($Tk.ha^{-1}$)	336579	325915	440106
Net return ($Tk.ha^{-1}$)	167336	368525	472568
BCR (total cost basis)	1.50	2.13	2.07
BCR (variable cost basis)	2.43	3.45	2.98

Note: Price of country bean Tk.16.43kg^{-1}, cucumber Tk.23.00kg^{-1} and pointed gourd Tk.22.00kg^{-1}.

3.8.Causes of pesticide used

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Farmer usually used pesticide for controlling insect pest in their fields and they opined that pesticide was sprayed for getting better yields (Table 8). Without pesticide used vegetable production may hamper and decreases yield which cause production loss (Chanda *et al*., 2022). In a study it found that most of the farmer did not take safety measures when spray insecticide (Yeasmin *et al*., 2018) and they faced health problem (Islam *et al*., 2015). Unavailability and costly of bio pesticide was another cause for huge used of pesticide. A number of farmer did not know other method such as IPM and biological pest control for controlling insect pest of their fields. Lack of knowledge and training on IPM technology used were the reason of havoc pesticide used by farmer. So farmer used sporadic pesticide in their vegetable fields. Due to pesticide used farmer face different health problem such as eye, skin and nose itching, headache, chest pain, breathing, dry cough and digestive problem (Islam and Haque, 2018; Islam *et al*., 2022).

Table 8: Causes of pesticide used by farmer

Farmer opinion/causes	Score	Mean value	Ranking
Control insect pest for better yield	335	3.72	I
Cultivation hampered without use of pesticide	291	3.23	II
Less effective and costly of bio-pesticide	282	3.13	III
Less knowledge on other method	264	2.90	IV
No training on IPM technology	254	2.82	V

3.9.Constraints on IPM technology use

Pheromone trap was most effective method used in vegetable fields. But farmer did not use it properly. Most of the farmer opined that IPM technology was time consuming method (Table 9). Someone said it was laborious to make trap and pheromone and someone argue it was laborious technology, which was showed in another study (Kamal *et al*., 2018). Many farmers said that lack of sufficient trap was the main cause for not used pheromone in the farmer fields. Some farmer but not bigger were argue that it was less useful method and it need to spray pesticide if though pheromone was also used. IPM practices could be achieved by increasing farmer knowledge about IPM, developing positive attitude towards these practices. It was showed in a study that IPM used reduces pesticide application and cost in vegetable cultivation (Das *et al*., 2016; Rahman *et al*., 2018).

Table 9: Constraints on IPM technology used

Farmer opinion/causes	Score	Mean value	Ranking
Time consuming method	341	3.79	I
Very laborious technology	305	3.39	II
Less knowledge on IPM technology	274	3.04	III
Less useful method	244	2.71	IV
Lack of sufficient pheromone trap	237	2.63	V

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3.10. Constraints on safe vegetable cultivation

Safe vegetable cultivation had many constraints that main problem was severe attack of disease and insect in vegetable fields especially at hot weather (Table 10). There was a high infestation of insect pest and disease at vegetable cultivation. Lack of proper knowledge and training on safe vegetable cultivation was one of the problem for expansion of safe vegetable cultivation. Some farmer opined that lack of sufficient supply of bio-pesticide and IPM material and also available pesticide in market were backwardness of safe vegetable cultivation (Alim *et al*., 2023). Market facilities and getting proper market price of safe and organic vegetable were the uneager of farmer for safe vegetable cultivation. In some cases vegetable cultivated in organic way was not shown smooth and shiny like other vegetable, so that farmer did not get proper price in market as their production cost was similar or high. Another backwardness noticed by the researcher was lack of motivation and awareness about pesticide concern and health issue, health benefits and environment safely of organic and safe vegetable cultivation. But in a study it showed that farmer had positive attitude about the environmental degradation and residue effect of pesticide used in the fields (Akter *et al*., 2015; Arfin *et al*., 2012).

Table 10: Constraints of safe vegetable cultivation

Farmer opinion/causes	Score	Mean value	Ranking
High insect and disease infestation	328	3.64	I
Lack of proper knowledge and training	291	3.23	II
Lack of bio-pesticide and IPM materials	273	3.03	III
Market facilities for safe vegetable	253	2.81	IV
Lack of farmer motivation	235	2.61	V

4. Conclusion

Safe vegetable cultivation farmer cultivated their own collected seed in line by well prepared bed in their land. Some farmer used hybrid seed bought from seed dealer at local market. They used irrigation water by shallow machine and weeding done by hands, and herbicide used less as they used grass for cattle fodder. Different agronomic management done by farmer was de-topping, stalking, earthing up etc. of which plant kept disease and insect free.

Some farmer also used repellent crop for crop protection. Farmer used different methods for insect pest control and farmer used combined method for controlling pest at a time. They sprayed synthetic pesticide along with bio control method such as bio-pesticide, sex pheromone trap, yellow trap and hand picking for control insect pest in their fields. Farmer used bio-fertilizer along with chemical fertilizer for safe vegetable cultivation and getting higher yield. They used different types of organic fertilizer such as manure, vermin compost, bio-fertilizer etc.for safe vegetable cultivation. Some farmer used bio pesticide such as bio-chamak, eco-mac, bio-envir, bio-cin etc. at their fields for controlling insect pest several times along with sex pheromone and yellow trap. They also used herbicide such as panida, prime axim, etc. for controlling weed at vegetative stage one or two times in a season.

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Main causes of pesticide used by farmer were for controlling insect pest, unavailability and costly of bio pesticide, less knowledge and training of other method such as IPM and biological pest control, lack of knowledge and training on IPM technology etc. Main constraints of IPM technology opined by farmer was time consuming and laborious method, less useful and less knowledge of farmer on IPM technology.

Though farmer practices some organic methods of vegetable cultivation but fully did not follow safe vegetable cultivation. Farmer spray pesticide along with IPM practices. Farmer required to motivation for safe vegetable cultivation. Create market facilities, demand, value chain, proper price for organic vegetable, farmer motivation can promote and enhance safe vegetable cultivation.

Human participants statement: This study was conducted for social research, where human participants provided oral consent before conducting formal interviews using a questionnaire. Ethical approval was not required for this study.

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