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Risk identification survey during spraying operation in mango plantation in Konkan Region

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Abstract

The efficient and judicious use of pesticides is very important. Hence, to assess the status of mango growers in Konkan region, the survey for risk identification during spraying in mango orchard was carried out. The outcome of risk identification survey revealed that, the use of portable horizontal triplex pump power sprayer was found dominant in Konkan region especially for mango orchard spraying. It was evident that, 74 per cent farmer's had health complaints and 68 per cent of farmer's had frequent hand injury at the time of pesticide application. Among the surveyed farmers, only 18 per cent used hand gloves during pesticide application. Among the surveyed farmers, only 8 per cent used mask and only 14 per cent used apron. None of farmer used any eye protecting device during pesticide application. In work and work place related occupational hazards, 74 per cent suffered from inhalation issues, 66 per cent suffered from respiratory airways diseases, 88 per cent suffered from skin burn issues and 82 per cent suffered from body ache and headache problems. Considering posture-related occupational hazards, 78 per cent, 68 per cent, 86 per cent, 88 per cent, 90 per cent, 78 per cent and 78 per cent male farmers were suffered from body pain, back pain, leg pain, knee pain, hand pain, neck pain and waist pain, respectively. Aspect in pesticide spraying related to requirement of job specialization, among the surveyed farmers, 66 per cent had opinion that the pesticide spraying operation was simple and uncomplicated, while 34 per cent responded opposite of it. Whereas among the surveyed farmers, 66 per cent had opinion that spraying does not need elementary skill, while 34 per cent responded opposite of skill requirement aspect. The ergonomic aspects in pesticide spraying operation related to ease of work and workplace safety, among the surveyed farmer's, 78 per cent had opinion that there was ease of work and safety at workplace, whereas 22 per cent responded opposite of it. Whereas Among the surveyed farmers, 22 per cent opinion that spraying carried out at relaxed work, while 78 per cent responded opposite of work posture.

Keywords: Pesticide hazards, health issue, protective gear, spraying, risk

Introduction

Mango is an important fruit crop in Konkan region where the area under mango cultivation has increased to 1,64,000 ha (Salvi *et al.*, 2009) ^[11]. This, 1,11,715 ha area is productive and contributes to the production of 3,53,066 tonnes of fruit (Anonymous, 2018) ^[1]. Lateritic hard rock area in Sindhudurg district accounts for about 30% of the total area in Vengurle, Malvan and Deogad tehsils and 10-15% of the total area in Rajapur, Lanja, Ratnagiri, Guhagar, Dapoli and Mandangad tehsils in Ratnagiri district. Considering the characteristics of mango tree cover, pesticide spraying in mango is usually done with a power sprayer. The application of key integrated technologies in mango cultivation does not pay attention to the management of pesticides and their application techniques, especially in spraying. Skin moisture, as influenced by relative humidity tends to increase the dermal absorption of pesticides (Meuling *et al.*, 1997) ^[8]. Moisture facilitates pesticide transfer from treated carpets. Small changes in percent moisture produced significant changes in transferable chemical residues (William *et al.*, 2002) ^[12]. Several factors can affect exposure during pesticide handling. Exposure to certain pesticides can also produce sweating and there can be combined effects with exposure to heat. In addition, pesticides are absorbed through hot, sweaty skin more quickly than through cool skin. The form of formulation of pesticide products may affect the extent of exposure. Liquids are prone to splashing and occasionally spillage resulting in direct skin contact or indirect skin contact through clothing contamination. Therefore, it is important to consider the information related to general health status, work output, precautionary measures taken and occupational health hazards for risk identification survey during spraying mango plantation in Konkan region.

Methodology

Survey for Risk Identification during Spraying Operation in Mango Orchards

A questionnaire was prepared for collecting the formal information related to description of the workplace, details of workers and aspects in risk identification in spraying based on Saha *et al.*, 2006^[10] and Mali, 2021^[9]. The farmers were informed about details of survey and appealed to give formal responses regarding the workplace and their personal information.

Description of workplace

The name of the village, farmer's name, information about the field, information about orchard, spraying operation being carried out, etc. were covered in description of workplace. The majority of workforce were the men workers performing pesticide spraying related tasks such as mixing of chemicals, loading pesticide tank and pesticide spraying on crops.

Workers description

The workers personal information (name, age, height, weight, marital status, educational status, annual income, experience, etc.), along with their physical health status, occupational hazards related to work and workplace were recorded.

Checklist and response sheet for risk identification in spraying

The checklist comprised of information related to work and workplace, and working posture related occupational hazards.

Questionnaire for health hazards and risk assessment in spraying operation

1. Description of the workplace

- a. Name of the village
- b. Farmers Name
- c. Area of the field, (ha)
- d. Type of plant
 - Plant population, (nos.)
 - Height of plant, (m)
- e. Distance of field from residence unit, (km)

2. Worker description

- a. Name
- b. Age, (y)
- c. Sex, (Male/Female)
- d. Height, (m)
- e. Weight (kg)
- f. Marital status
- g. Educational status
- h. Annual income, (Rs.)
- i. Experience in mango orchards, (y)
- j. Work schedule in a day, (Morning/Evening)
- k. Posture adopted during spraying operation, (Standing/Sitting)
 - l. General health status during spraying operation
 - Previous complaints
 - Previous injuries
 - m. Precautionary measures taken (safety kit)
 - Hand gloves (Yes/No)
 - Mask (Yes/No)

- Apron (Yes/No)
- Eye protector (Yes/No)

3. Occupational Hazards

- a. Work and workplace related
 - Inhalation issues
 - Respiratory airways diseases
 - Skin burn issues
 - Body ache and headache problems
- b. Posture related
 - Body pain
 - Back pain
 - Leg pain
 - Knee pain
 - Hand pain
 - Neck pain
 - Waist pain

Polar questionnaire for risk identification in spraying

The various aspects, *viz.*, job specialization, skill requirement, work place safety and work posture related to pesticide spraying operation were studied. Polar responses were recorded from the farmers for accurate and unambiguous assessment of spraying risk. The information regarding aspects in pesticide spraying were taken in the form of 'Yes' or 'No' type questions. The 'Yes' response indicated that the apparent absence of any risk and 'No' response indicated that there was a need to modify the workplace. The severity of problem was analyzed by rating given (Saha *et al.*, 2006^[10] and Mali, 2021^[9]) to the 'No' answer between 0 to 5 scale (0 for not applicable, 1 for strongly disagree, 2 for disagree, 3 for neither agree nor disagree, 4 for agree and 5 for strongly agree).

Polar questionnaire for general aspects in pesticide spraying operation (Worker's answers/ ratings)

1. Requirement of job specialization

Pesticides spraying operation is simple and uncomplicated. Yes/No. If No, rate the following: (Enter 0-5)

- a) Equipment and methods used are specialized for pesticides spraying.
- b) The position adopted for pesticides spraying is not comfortable
- c) The workers perform multiple tasks
- d) Pesticide spraying is predominantly dynamic work.

2. Skill requirement

Pesticides spraying doesn't require elementary skill. Yes/No. If No, rate the following: (Enter 0-5)

- a) Pesticide spraying requires knowledge and skillful ability.
- b) Pesticide spraying demand training for skill acquisition.

Polar questionnaire for ergonomic aspects in pesticide spraying operation

1. Workplace safety

Does the workplace compatible with human dimension. Yes/ No. If No, rate the following: (Enter 0-5).

- a) Canopy is away from normal reach of nozzle in horizontal or vertical plane (> 54.3 cm).
- b) Spray reach is fixed or minimally adjustable.
- c) Location of sprayer is not adjustable.
- d) Operator encountered with obstacles.

2. Work posture

Spraying allows a relaxed work posture. Yes/ No. If No, rate the following: (Enter 0-5)

- Neck/shoulder are not maintained at an angle of about 15° flexion
- Frequent movement of the forearm and wrist
- Back position is bent and twisted
- Hips and legs are not well supported in standing position while pesticide spraying.
- The movement of body is one sided and unsymmetrical

Results and Discussion

Survey of risk identifying in pesticide spraying for mango crop

Description of workplace

In the survey of risk assessment of spraying, the workplace information was collected. Total fifty mango growing farmers were surveyed. Among the fifty surveyed farmers, 37 farmers had marginal land holding i.e. below 0.4 ha while remaining 13 were categorized as small farmers with land holding more than 0.4 ha and below 2 ha. The mango plant population owned by surveyed farmers was observed in range of 10 to 250. It was observed that, mostly well drained type field was used for mango orchard. The height of mango tree was in the range of 3 to 4.75 meters. The orchards were located at 0.1 to 5 km distance from their residences.

Description of workers and occupational hazards

The information related to pesticide spraying worker including their details, general health status, work output, precautionary measures taken and occupational health hazards were collected. As per surveyed information, pesticide spraying work was done by totally male dominant farmers. It was observed that out of 50 farmers, 14 per cent farmers were having their age below 34 years, whereas 86 per cent farmers were elder than 34 years. The height of 58 per cent farmers were below 1.65 m, whereas 42 per cent of farmers were taller than 1.65 m. Among the surveyed farmers, 36 per cent and 64 per cent farmers had weight below and above the 62 kg, respectively. Out of surveyed farmers, 26 per cent had experience below 5 years of pesticide spraying in mango orchard, whereas 74 per cent had experience of more than 5 years. It was observed that, 88 per cent surveyed farmers were literate. Out of surveyed farmers, 90 per cent of farmers were married. Among the surveyed farmers, 70 per cent farmers preferred morning slot for pesticide spraying. It was observed that the annual income of 74 per cent farmers was more than 90,000/- whereas that of 26 per cent farmers was less than 90,000/-.

Out of surveyed farmers, 100 per cent farmers adopted standing posture at the time of spraying using portable HTP power sprayer. Out of surveyed farmers, it was observed that, 74 per cent farmers had health complaints and 68 per cent of farmers had frequent hand injury at the time of pesticide application. Among the surveyed farmers, only 18 per cent farmers used hand gloves whereas 82 per cent performed pesticide spraying without hand gloves.

Among the surveyed farmers, only 8 per cent and 14 per cent

farmers used mask and apron, respectively. Out of surveyed farmers, not a single farmer used any eye protecting device during pesticide application.

Work and workplace related issues

Considering the work and workplace related data, it was observed that among pesticide spraying farmers, 74 per cent had inhalation issues, 66 per cent had respiratory airways diseases, 88 per cent had skin burn issues and 82 per cent had body ache and headache problems.

The posture related health hazards

Considering the posture related health hazards among surveyed farmers, 78 per cent had body pain, 68 per cent had back pain, 86 per cent had leg pain, 88 per cent had knee pain, 90 per cent had hand pain, 78 per cent had neck pain and 78 per cent farmers had pain in waist.

Aspects in pesticide spraying operation

Aspects in pesticide spraying operation are rated as per farmers' rating in 0 to 5 scale.

Requirement of job specialization

Among the surveyed farmers, 66 per cent had opinion that the pesticide spraying operation was simple and uncomplicated, while 34 per cent responded opposite of it. The bar graph showing the farmers' rating about requirements job specialization in pesticide spraying operation is given in Fig. Out of 34 per cent farmers, 14 per cent farmers were strongly agreed, 74 per cent were agreed, 4 percent farmers were neither agreed nor disagreed and 8 per cent were disagreed with the facts that the equipment and methods used were specialized for pesticide spraying. Similarly, 84 per cent farmers strongly agreed, 10 per cent farmers agreed and 6 per cent farmers disagreed with the thought that the position adopted for pesticide spraying was not comfortable. It was observed that, 76 per cent farmers agreed and 24 per cent farmers were disagreed that the workers perform multiple tasks. It was found that, 88 per cent farmers strongly agreed and 12 per cent farmers were agreed that pesticide spraying was a predominantly dynamic work.

Skill requirement

Among the surveyed farmers, 66 per cent had opinion that spraying does not need elementary skill, while 34 per cent responded opposite of it. The bar graph showing the farmers rating about skill requirement is given in Fig. In skill requirement, Among the surveyed farmers, 66 per cent farmers responded 'Yes' to the question of pesticide spraying doesn't require elementary skill, whereas 34 per cent farmers responded 'No'. Out of 34 per cent farmers, 74 per cent were strongly agree, 26 per cent were agree to pesticide spraying require knowledge and skillful ability. Similarly, 32 per cent were strongly agree, 62 per cent were agree and 6 per cent were neither agree nor disagree with the pesticide spraying demand training for skill acquisition. In skill requirement, 34 per cent had opinion that pesticide spraying required elementary skill.

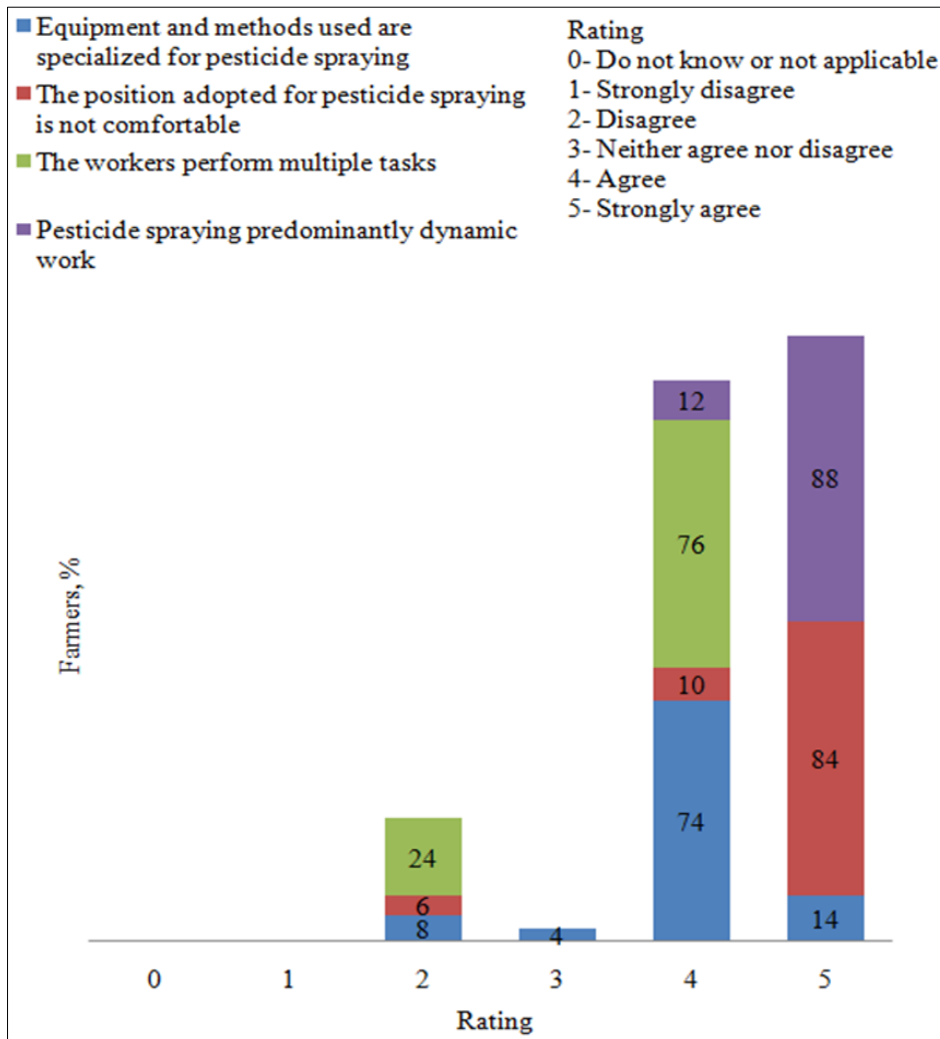


Fig 1: Farmer’s rating about requirement of job specialization in pesticide application

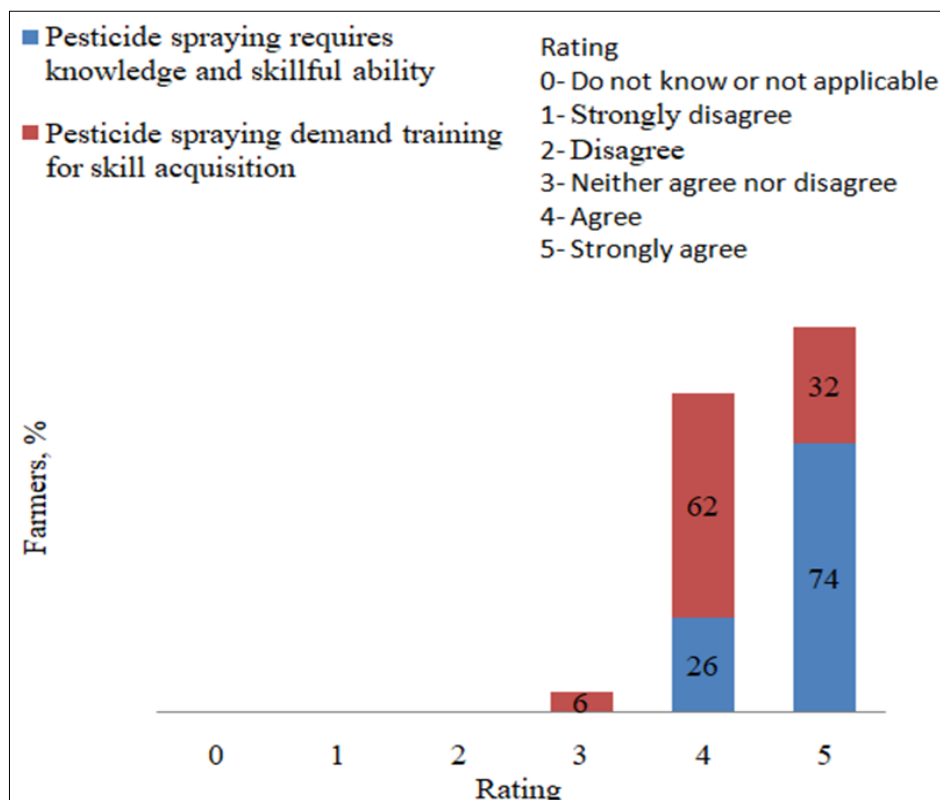


Fig 2: Farmers rating for elementary skill required in pesticide spraying operation

Ergonomic aspects in pesticide spraying

Ease of work and workplace safety

Among the surveyed farmer's, 78 per cent had opinion that there was ease of work and safety at workplace, whereas 22 per cent responded opposite of it.

In aspect related to ease of work and workplace safety, it was observed that out of 22 per cent, 42 per cent were strongly agree, 34 per cent were agree, 10 per cent neither agree nor disagree and 14 per cent were disagree with the fact that tree canopy was away from normal reach of nozzle in horizontal or vertical plane (> 54.3 cm). It was evident that, 20 per cent farmers were strongly agree, 22 per cent were agree, 8 per

cent were neither agree nor disagree, 14 per cent were disagree and 36 per cent farmers couldn't made their decision about the spray reach (was fixed or minimally adjusted). Out of 22 per cent farmers, 38 per cent were strongly agree, 40 percent farmers agree and 22 per cent had neutral opinion about the adjustable/shift able location of sprayer. About obstacles in spraying operation, 8 per cent farmers were strongly agree, 36per cent were agree, 10 per cent were neither agree nor disagree, 38 per cent were disagree and 8 per cent were strongly disagree. The bar graph showing the farmers rating about workplace with human safety is given at Fig.

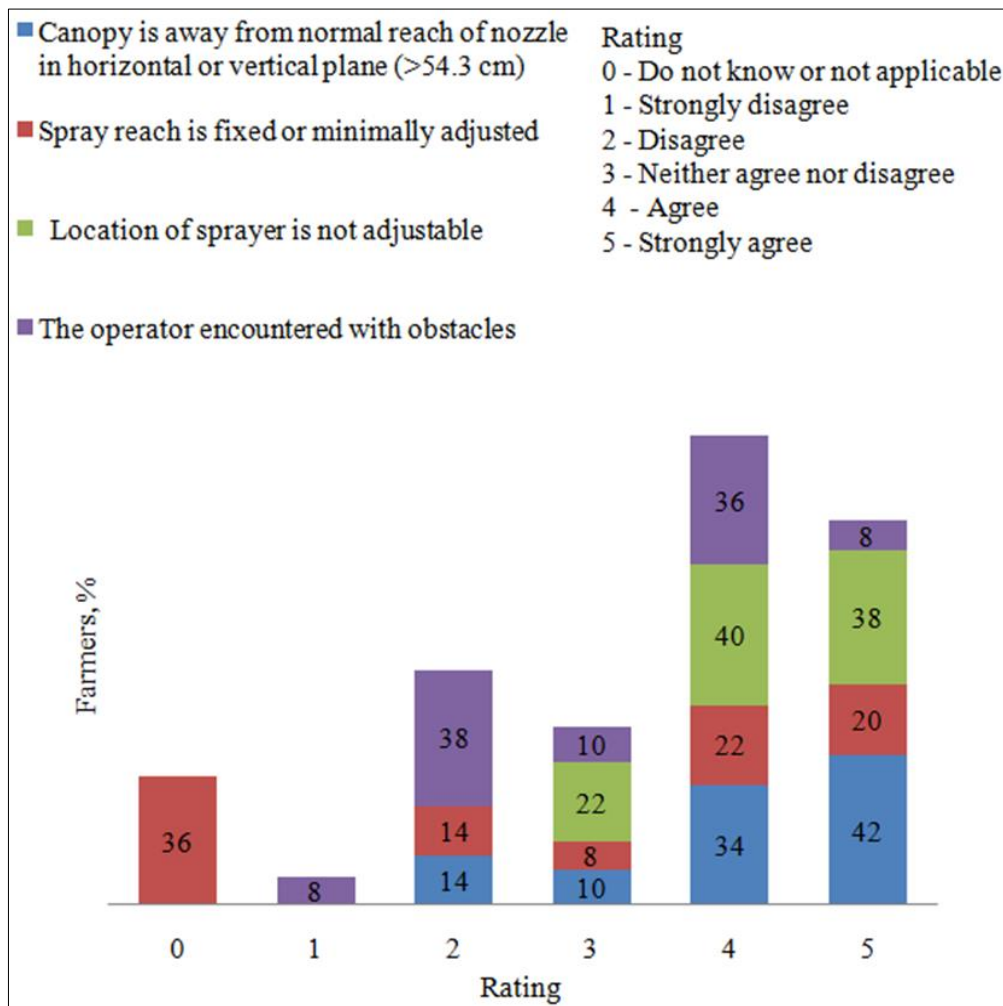


Fig 3: Farmer's rating about ease of work and workplace safety in pesticide spraying

Work posture

During the pesticide spraying operation using power sprayer the farmer's working posture affects the worker's efficiency. The working posture in pesticide spraying operation using portable HTP power sprayer was standing.

The bar graph showing the farmers rating about work posture is given at Fig. Among the surveyed farmers, 22 per cent opinion that spraying carried out at relaxed work, while 78 per cent responded opposite of it. Out of 78 per cent farmers, 50 per cent were agree, 18 per cent were neither agree nor disagree, 24 per cent were disagree and 8 per cent didn't responded to the question of whether the neck or shoulder were not maintained at an angle of about 15° that the target locations of plant. Similarly, out of 78 per cent farmers 36 per cent were strongly agree, 42 per cent were agree and 22 per

were neither agree nor disagree that there was frequent movement of forearm and wrist during operation.

28 per cent farmers were strongly agree, 48 per cent were agree and 14 per cent were neither agree nor disagree, 4 per cent were disagree and 6 per cent were strongly disagree that the back position was bent and twisted during work. It was observed that, 30 per cent farmers were strongly agree, 30 per cent were agree, 24 per were neither agree nor disagree and 16 per cent were disagree that the hips and legs were not well supported in standing position during pesticide spraying. It was found that, 14 per cent farmers were strongly agree, 44 per cent were agree, 20 per cent were neither agree nor disagree and 22 per cent were strongly disagreed that the body movement was one sided and unsymmetrical.

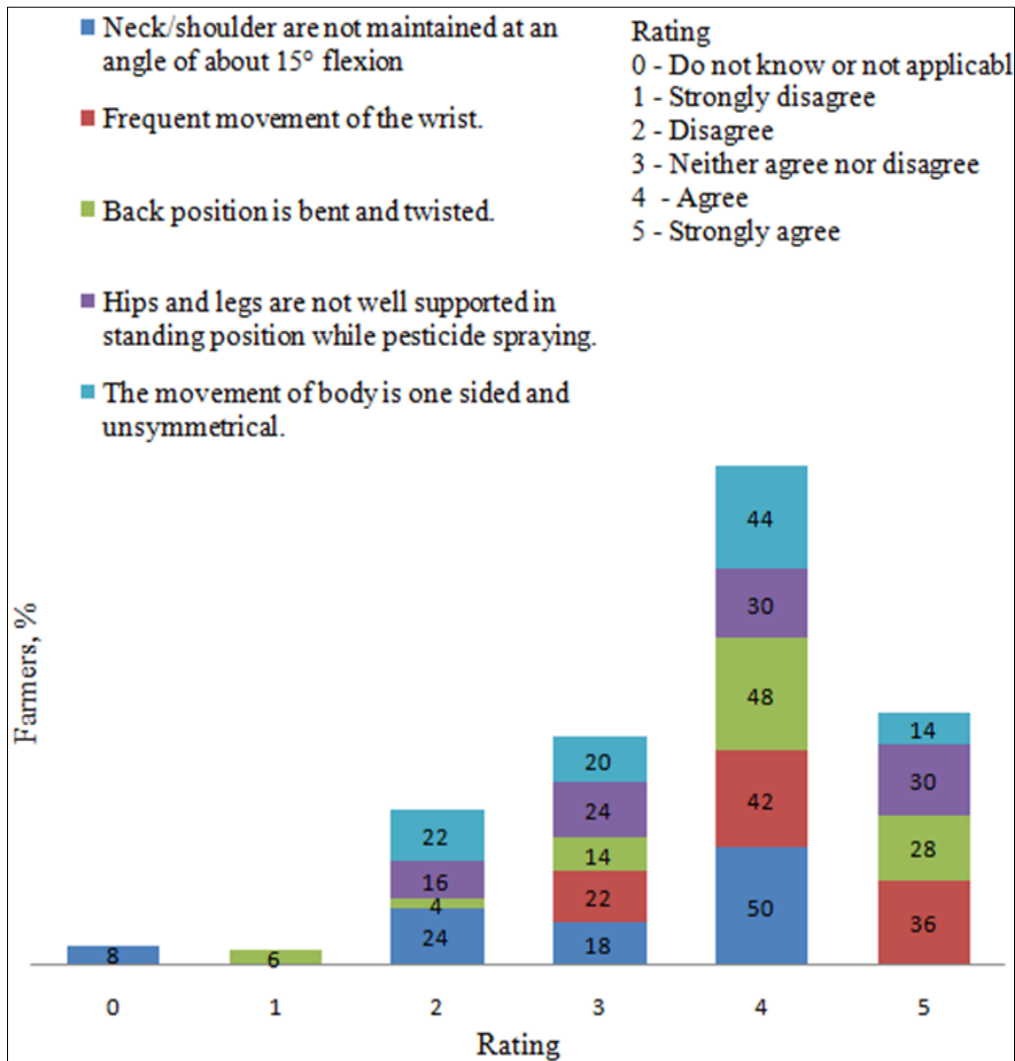


Fig 4: Farmers rating about work posture in pesticide spraying operation

Conclusion

1. As per surveyed information, pesticide spraying work was done by totally male dominant farmers.
2. The pesticide spraying operation carried out in standing posture.
3. As per the survey conducted on health hazards and risk assessment in spraying operation, the use of portable horizontal triplex piston/plunger pump (HTP) power sprayer was found dominant in Konkan region especially for mango orchard spraying.
4. It was evident that, 74 per cent farmer’s had health complaints and 68 per cent of farmer’s had frequent hand injury at the time of pesticide application. Among the surveyed farmers, only 18 per cent used hand gloves during pesticide application.
5. Among the surveyed farmers, only 8 per cent used mask and only 14 per cent used apron. None of farmer used any eye protecting device during pesticide application.
6. In work and work place related occupational hazards, 74 per cent suffered from inhalation issues, 66 per cent suffered from respiratory airways diseases, 88 per cent suffered from skin burn issues and 82 per cent suffered from body ache and headache problems.
7. Considering posture-related occupational hazards, 78 per cent, 68 per cent, 86 per cent, 88 per cent, 90 per cent, 78 per cent and 78 per cent male farmers were suffered from body pain, back pain, leg pain, knee pain, hand pain, neck

pain and waist pain, respectively.

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