A CASE STUDY

International Journal of Agricultural Engineering | Volume 10 | Issue 2 | October, 2017 | 664-670

e ISSN–0976–7223 ■ Visit us : *www.researchjournal.co.in* ■ **DOI: 10.15740/HAS/IJAE/10.2/664-670**

Perspective of the study of occupational safety issues and hazards for the agricultural workers: A survey

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Received : 26.04.2017; **Accepted :** 30.09.2017

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■ **ABSTRACT :** The agricultural sector is at the heart of rural India and continues to be a major contributor to the local and national economy. Those at the centre of this industry are farm families who represent 97% of the farming population. Engineering and technology have had both positive and negative consequences on humankind and the environment. Agriculture is not a safe occupation. Agricultural workers face a large number of health problems in the form of physical factors like extreme weather conditions, sunrays, etc.; chemical, toxicological hazards in the form of pesticides/fertilizers, etc. Many of which arise from their work. Clinically well recognized group of occupationally acquired health problems may be respiratory, dermatological, traumatic, poisoning and neoplastic in nature. Prevalence of some specific zoonotic diseases and behavioural health problems are also found to be more among them. Farming is as much a job as it is a way of life, an identity and a social representation for many. This identity has, however, in recent years been constantly threatened by yearly rises in farm accidents and fluctuations in farm deaths which climaxed in 2015 with more than 3000 people losing their lives and thousands of farmers injured during farming daily on Indian farms. Not only did 3000 families lose loved ones, whole communities and regions have been adversely affected by these deaths which have far ranging negative influence on the sustainability of rural areas and use of technology. Unfortunately one does not have to go far from the farm gate to find a farmer who has been severely disabled or injured as a result of a farm accident and often at times less further to the place of a farm death as farm accidents are so frequently fatal. In this paper we are going to preliminary research on the study of occupational safety issues and hazards for the agricultural workers in farming sector in the state of Uttar Pradesh, India and proposed a research model to study on the effect of innovation in farm technology on the health of the farm workers, various hazardous sector of agriculture and their effect on the farm workers.

■ **KEY WORDS :** Farm technology, Occupational safety, Hazardous sector of agriculture

■ **HOW TO CITE THIS PAPER :** Kumar, Sumit, Tripathi, Ashok, Pal, Surendra and D'souza, Prashant (2017). Perspective of the study of occupational safety issues and hazards for the agricultural workers: A survey. *Internat. J. Agric. Engg.*, **10**(2) : 664-670, **DOI: 10.15740/HAS/IJAE/10.2/664-670.**

The term 'agriculture' is generally used in a broad sense including all activities directly related to cultivating, growing, harvesting and primary processing of agricultural products, animal and livestock breeding including aquaculture, and agro forestry. The term also refers to all agricultural undertakings,

irrespective of size. An estimated 1.3 billion workers are engaged in agricultural production worldwide. This represents half of the total world labour force. Almost 60% of them are in developing countries. A great majority of agricultural workers are found in Asia, which is the most densely populated region of the world, with more than 40% of the world's agricultural population concentrated in China and more than 20% in India. The structure of the agricultural sector in India is rapidly changing, towards fewer and more cost-effective, larger but less labour-intensive units (Statistics India, 2012). In this line of business, rural isolation, periodically high workload, and changing structural and economic conditions together lead to physical as well as mental stress (Lundqvist, 1996a). The "costs" of safety in terms of e.g. money or time may be seen as directly subtracted from potential income, which for many Swedish farmers is low per hours worked (Lundgren, 2000). One characteristic of the agricultural sector is that work varies to a great extent and each person has many different work tasks, many different machines and tools as well as animals to handle. These conditions form a hazardous environment (Andersdotter *et al.*, 2000).

Farmers often have to develop, plan and solve their health and safety problems on their own, so improvements in occupational health and safety are therefore not so easily acquired and incorporated. The majority of farms in Sweden are small enterprises, often managed by the family, assisted by a substitute worker or a small number of employees. The requirement for manageability is high, *i.e.* there is a need for uncomplicated, cost-effective safety solutions, designed to fit the conditions in farming (Lundqvist, 1996b). Much has been done to promote health and safety, such as new legislation and technical improvements (Höglund, 1999). The challenge has been to detect and reduce hazards through prevention, and previous studies have shown that research, education, engineering and regulation have resulted in a reduction of injuries (Lundqvist and Gustafsson, 1992). These efforts are, however, not enough since the frequency of serious occupational accidents in the agricultural sector is still high (Thelin, 2002; Forsblom *et al.*, 2005). In India, where only 20% of the work force is directly engaged in farming, over 40% of all fatal work-related accidents occur in this occupation (Statistics India, 2009 and 2012). In 2012 the risk of long-term (>30 days) sick listing or permanent disability was 3.9 per 1000 workers in Indian farming and forestry (Forsblom *et al.*, 2005).

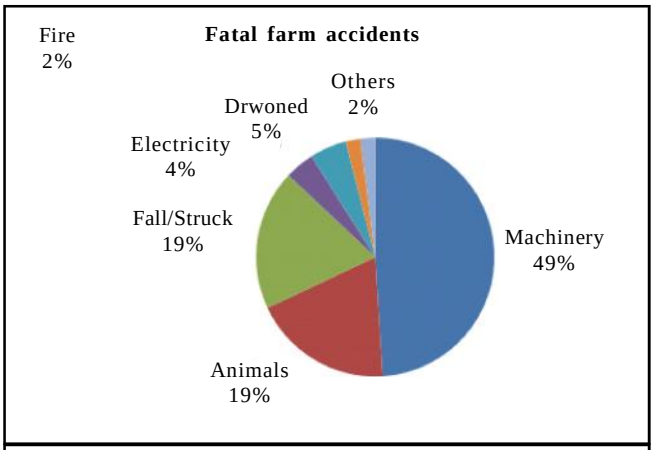

Fig. A : Total fatal from accidents

According to Health and Safety Authority of India (2015), farm vehicles and machinery account for the highest proportion of farm deaths (49% between 2006 and 2014) and accidents. 2876 people (total 5870 deaths), including 730 children, died as a result of vehicle and machinery use between 2006 and 2014

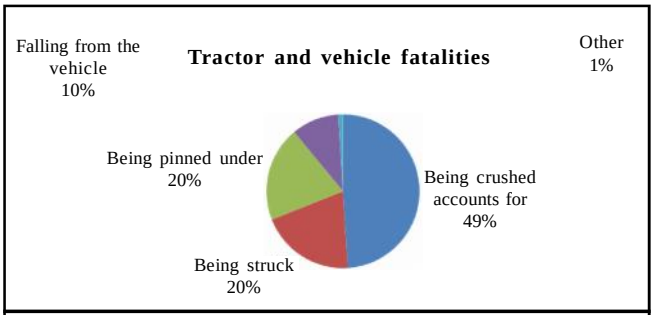

Fig. B : Total fatal from machinery accidents

According to WHO the health problems of the farmers or farm workers surveyed and following observation:

– A national farm survey indicated that ill health due to work occurs on 11% of farms. The principal causes of ill health were associated with manual handling, lung problems, infections and noise.

– Of farmers with occupational ill health, 50% suffer from chronic back pain.

– Regarding personal health, farmers have been identified as a group with a poor personal health profile (O'Shea, 2014). Male farmers between the ages of 15

and 64 have a death rate much higher than that of most other workers.

– There is strong international evidence that healthy farmers suffer fewer injuries at work.

– Stress is associated with both high accident levels and disease of the circulatory system.

Research on agricultural injury risks is extensive and many programmes for increased safety have been conducted internationally. Studies focusing on behavioural theories and models have been applied in agricultural interventions (e.g. Glasscock *et al.*, 1997). Despite great efforts to change safety attitudes, changes in behaviour have been limited and research has failed to find an association between safety attitudes and farm accidents (Murphy *et al.*, 1996). Murphy (2003) therefore discussed the farm safety-risk paradox, that is, the incongruence between farm people's safety knowledge, values, and practices. In order to influence safety behaviour, attitudes towards risks and safety are of interest as well as the associations between attitudes and behaviour. Murphy (2003) stated that here is a need for a systematic, long-term, holistic approach if we are to make major improvements in farm safety.

The role of social and psychological factors for safety outcomes ought to be further explored. A study in Swedish fishery (Eklöf and Törner, 2002) suggested that safety work might progress by developing fishermen's understanding and manageability of safety problems. The same may also be applicable in farming. In Sweden, fishery as well as farming are small businesses limited by forces of nature, performed in a hazardous environment under demanding conditions, by people accustomed to managing the constraints of work independently.

■ METHODOLOGY

Hazard identification :

Hazard identification is the process of identifying all hazards in the workplace. There is no set method for grouping agricultural injury and illness hazards. Most production agriculture hazards overlap into different hazard categories. One way to group them would be by major hazards listed in the OSHA Dairy Local Emphasis Programme:

– Manure storage facilities and collections structures

– Dairy bull and cow behavior/worker positioning

– Electrical systems

– Skid-steer loader operation

– Tractor operation

– Guarding of power take-offs (PTOs)

– Guarding of other power transmission and functional components

– Hazardous energy control while performing servicing and maintenance on equipment

– Hazard communication

– Confined spaces

– Horizontal bunker silos

– Noise

Types of risk :

The variable working conditions in agriculture can be compressed into some specific features, which increase the risk of occupational accidents (adapted from Forastieri, 2001):

– The work is carried out in the open air, exposing the workers to climatic conditions.

– The work is of a seasonal nature and certain tasks are urgent in specific periods.

– A variety of tasks must be performed by the same person.

– There is great variation in working postures and the length of the tasks performed.

– Contact with animals and plants brings exposure to bites, infections, allergies and other heath problems.

– There is contact with chemical and biological products.

– A variety of machines are used.

– The work is often performed in isolation out of sight of others.

– Emergency services are often delayed in time of accidents due to the remoteness of a high percentage of the work sites.

– The worker's home is often embedded in the farm for a high percentage of farm populations, increasing the risk of farm-related accidents to children.

– There are high proportions of young and old workers.

Hence, the types of the hazardous sector of agriculture are given below

Traumatic injury :

Work injury data are not as readily available for agriculture as for other industries. The reasons for this

are varied, including that most Indian farms do not fall under the reporting requirements of the occupational safety and health administration because they do not have 11 or more employees. Also, many persons who work on farms are not covered by workers' compensation insurance systems. Death certificates have been widely used to identify fatal injuries on farms. This practice has been found to lead to an underestimation of the number of such deaths.

Respiratory illness :

Various respiratory disorders occur in agricultural workers. The disorders are a common problem in this group of workers and are a cause of substantial morbidity. These disorders overlap considerably. For example, in a worker who has had farmer's lung, chronic bronchitis may develop as a complication.

Exposures that play an important role in causing respiratory disorders include grain dust, dust and gases in animal confinement units, mold and thermophilic bacteria in hay and grain, and silo gas. Many of the bioaerosols inhaled by agricultural workers are rich in endotoxin, which has been associated with both acute and chronic illness. Evidence exists that other substances in the organic dust, including mycotoxins and silica, play an important role as well.

Hearing loss :

Farmers are regularly subjected to loud noises when working with machinery such as tractors, feed grinders, and chain saws. Noise made by large animals such as pigs can be loud enough to damage hearing. Hearing loss has been documented as early as the teenaged years in farm youth. As with other industries where high levels of noise are a problem, the noise-induced hearing loss initially occurs in the region of the cochlea responsible for higher frequencies. If noise exposure continues, the hearing loss extends to lower and higher frequencies, making normal human speech difficult to understand.

Cancer :

The overall cancer risk for fanners is lower than for the general population. The risk for common cancers such as those of the lung and colon is lower in farmers. That for several types of cancer, however, is increased in farmers, including leukemia, Hodgkin's disease, non-Hodgkin's lymphoma, multiple myeloma, and cancers of the lip, stomach, skin, prostate, brain, and connective tissue. With the exception of cancer of the lip, the relative risk for these cancers is fairly low but has been identified in most studies of cancer in agricultural workers. Evidence exists that ongoing exposure to pesticides, insecticides, herbicides, and fungicides may be linked to an elevated relative risk for some cancers, but not all studies find a relationship between exposure to farm chemicals and cancer.

Farm chemical poisoning :

Pesticide exposure can cause serious illness and death. Illness from pesticide exposure is likely frequently not recognized or reported as being linked to this exposure. Various pesticides can cause acute illness. M organophosphates irreversibly block the enzyme acetylcholinesterase, causing acetylcholine to accumulate at nerve synapses and the neuromuscular junction and leading to excess parasympathetic stimulation. Signs and symptoms of organophosphate poisoning include bradycardia, hypotension, salivation, lacrimation, urinary incontinence, diarrhea, vomiting, abdominal cramping, bronchospasm and bronchorrhea, muscle fasciculations and weakness (which can cause respiratory failure), confusion, hallucinations, seizures, and coma. Treatment of this problem includes the anticholinergic agent atropine sulfate and oximes such as pralidoxime chloride, which are used to displace the organophosphate from cholinesterase.

Dermatoses :

Occupational skin disorders are common in agricultural workers. The effects of sun exposure are an important cause of morbidity in this occupational group, particular- ly in those with fair skin. Persons who sunburn easily are at increased risk for skin cancers. The most common type of skin cancer in agricultural workers and in the general population is basal cell carcinoma. A variety of farm chemicals and materials used for veterinary care can cause allergic contact dermatitis. Important causes of this problem include many pesticides, fertilizers, topical antibiotics designed for veterinary use, and latex.

Zoonoses :

A long list of pathogens can cause zoonotic disease in agricultural workers, including bacteria, viruses,

rickettsiae, chlamydiae, parasites, and fungi. The zoonotic disorders range in severity from fungal infections such as ringworm that are easily treated to life-threatening problems like *Rabi*es or anthrax. Measures to prevent these infections include maintaining the health of farm animals, avoiding skin contact with animals known to be infected, and wearing respirators approved by the National Institute for Occupational Safety and Health when working in high risk situations where diseases such as brucellosis and Q fever may be contracted by inhalation.

Musculoskeletal disorders :

Agricultural production labour is often physically demanding and may involve repetitive motions, characteristics associated with an increased risk for acute and chronic musculoskeletal disorders. In California, workers' compensation data show that sprains and strains make up more than 40% cases of lost work.

Green tobacco sickness :

Workers harvesting tobacco by hand are known to suffer from an illness that consists of nausea, vomiting, weakness, diarrhea, headache, and dizziness.88 This problem is caused by the dermal absorption of nicotine during the harvest process.

Methodology used for research :

The main objective of this study was to study of occupational safety issues and hazards for the agricultural workers in farming sector. For this purpose all 12 blocks were selected from Meerut district. From each selected blocks 50 farmers participated in the study. Care was taken that the respondents were from each level of farming, namely low level farmers, middle level farmers and high level farmers.

Research design :

The research is a descriptive research. It made use of both qualitative and quantitative tools in analyzing the data gathered through questionnaire, interview and observation.

Sampling plan :

Three stage stratified random sampling has been used to draw the sample of farmers in which blocks were taken as first stage unit, village as second stage unit and farmers as final stage unit. Data were collected from 600 farming families, 50 farmers each from all 12 blocks.

Selection of the respondents :

To make the sample representative respondents were selected from each level and care was taken that each level of farmers were duly represented. Thus, the survey was conducted with the help of well designed questionnaire which have 50 questions prepared for this purpose. The data were also gathered by personnel interviews of the farmers.

Data collection :

The data were collected from different blocks of the Meerut by collecting information from the farmers of the different level of land holdings by the interview method and also with the help of questionnaire. The content of these statements was modified slightly by the researchers to make them more appropriate for participants. The collection of the data takes place by following:

Primary sources:

Interview :

It is a conversation carried out with a definite aim of obtaining certain information. Interview was designed to gather valid and reliable information through the responses of the interviewee to a planned sequence of questions. Interview took both structured and unstructured forms. That is though content and the procedure involved were designed in advance there were instances where follow up questions not planned for were asked for further clarification.

Questionnaire :

Questionnaires are made of by pilot study of the farm machinery status and the hazardous effect of it by different old records of them by other researches, different articles on them and by personal sighting observation of the villages. This took the form of a list of questions given to respondents to answer with the rational of getting data on the topic under study. The questions in the questionnaire took two forms; open ended questions and close ended questions. The close ended questions offered a set of alternative answers from which the respondents were asked to choose the one that most closely represents their view. The open ended questions

on the other hand were not followed by any kind of choice. With this, the respondents' answers were recorded in full. The respondents again answered the questions the way he or she understood them.

Development of the questionnaire :

The items of the questionnaire were developed with help of review of literatures related to the farm industry. After collection of the data for the questionnaire from the review, a list of questions was developed. Two items were rephrased for better understanding of the respondents and no items were deleted or added. The final questionnaire was thus developed.

For development of the questionnaire insights were taken from the following:

– WHO guidelines in 2013; and ICAR, 2015 (Hazardous sector and its effect Questionnaire)

Personal observation :

The researcher undertook personal observation through the farming environment of the farmers to examine the process of farming, use of nature of farming by different level of the farmers, way of use of machine tools and precautions used by the farmers. The researcher again visited the different villages of different blocks and observed that the farming and use of farming tools.

Secondary sources :

Secondary data is data collected for some other purposes, other than the research in question. Examples of sources of secondary data are encyclopedia, textbooks, magazines, journals, newspaper, internet, websites and articles.

Data analysis plan :

Design of experiment is a powerful analysis tool for modeling and analyzing the influence of different factors on the performance output. The most important stage in the design of experiment is the selection of different controlling factors. Exhaustive literature review suggested that the health status and injuries were selected as fixed factors for statistical analysis. An important technique for analyzing the effects of different factors on a response is to perform analysis of variance (ANOVA). An ANOVA decomposes the variability in the response variable amongst the different factor. In the present investigation for different health status and injuries data depends upon two factors so 2-way analysis of variance has been performed to know the variability in the response amongst the different factor.

Variation analysis used to graphically display the trends in the data and to help to analyze the problem of prediction. The analysis can be made by the any of six different trends or regression type: liner, logarithmic, polynomial, power, exponential and moving average relations. The type of data determines the type of relation to use. A relation of model is most accurate when its R-square value is at or near one. When the relation fit to a maximum R-square value, the ratio or model is chosen for relating the different responses (tensile strength, compressive strength, flexural strength, and wear rate) with physical properties.

The analysis of the data collected was done at the end of the data collection. The responses were classified and summarized on the basis of the information provided by the respondents. The analysis was done using both qualitative and quantitative tools. With the quantitative tools, the current version of Statistical Product and Services Solution (SPSS) data analysis programme, Microsoft excel, absolute figures, tables, percentages, and statistical tools such as graphs, charts, maps, diagrams were used, whereas qualitative made use of descriptions, analysis of feedback from interview. The data collected from the employees of all the 20 hotels of the Noida city has been analyzed by Cronbach's alpha (α).

Co-efficient alpha is an appropriate reliability estimator for *composite* measures containing multiple components. A component may be a test item, a judge, a Thematic Apperception Test (TAT) card, a survey question, a subtest, or a test that is being combined into a composite test battery. Multiple components may be homogeneous in the sense of measuring a single latent variable, or they may be heterogeneous in the sense of measuring two or more factors or latent variables. Because of co-efficient alpha's flexibility, its use is ubiquitous in most areas of psychology as well as in many other disciplines. Co-efficient alpha may be computed using variance components but is ordinarily computed by the following equation:

$$\alpha = \frac{n}{(n-1)\left[1-\frac{\Sigma_i V_i}{V_t}\right]} \qquad (1)$$

where V_t is the variance of test score and V_i is the variance of the i^{th} component and the total score on the test is the sum of the n component scores. It is important to note that co-efficient alpha can be computed on the n components of a measure, the n components grouped into split halves, or the n components grouped into three or more parts. In these entire applications co-efficient alpha is still a lower bound to the true reliability.

Conclusion :

After the observation of the different types of research and government and non-government data about health condition and safety of the farmers of India, it concluded that the fatal accidents and injuries of farmers are more in the India than other farming countries. And the reason behind it was the unawareness of the safety issues and proper procedure of the use of machinery and other things. Agricultural education is main factors because farmers of the India are using traditional farming and they have lack of knowledge of the proper forming and use of machineries. So if proper training would be provided to them then the accidents at the farming workplace should be reduced.

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