Safety Interventions for Farm Operations and Equipment to Prevent Occupational Health Hazards

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Introduction

Agriculture in the country is carried out in about 140 million ha area employing more than 50% of the Indian workforce as of 2018 and contributing 17-18% to the country's GDP. India ranks second worldwide in farm production. The Economic Survey of India 2020-21 report stated that the total food grain production was recorded as 296.65 million tonnes and production of horticulture crops reached a record 331.05 million metric tonnes. India has the largest livestock population (535.78 million), which is 31% of the world population, with milk production of 208 MT.

The population of tractors, power tillers, draft animals, farm workers, diesel engines, electric motors and combine harvesters are estimated to be about 8.79 million, 0.705 million, 30.77 million, 230 million, 9.683 million, 20.453 million and 0.04 million, respectively (Singh and Singh, 2021). The power availability per ha is 2.761 kW. The farm power available is being utilized in various mobile and stationary farm operations in the country. The agricultural operations are performed on the field and off-field, where many unit operations are carried out by the farm workers (230 million) in the country. The share of men and women in farm workers is 11:9. It is also known that modern technologies are used mostly by men and women workers work with their traditional tools. Perhaps more than any other occupational group, agricultural workers are exposed to harsh environmental parameters that are potentially harmful to their health and well-being. Farmers and farm workers suffer from increased respiratory diseases, noise-induced hearing loss, skin disorders, certain cancers, chemical toxicity, and heat-related illnesses. Precautions can be taken to minimize or eliminate these potential hazards. The present paper aims to study the need for safety interventions in farm operations and rural households.

Status of Occupational Health Hazards

Compared with other industries, agriculture employs the largest number of workers and provides a significant number of jobs worldwide. Nearly 40% (450 million) of workers are in the farming sector globally and represent more than 40% of the total agricultural labour force (Hurts, 2007). Similarly, according to the ILO, about 317 million people worldwide suffer from occupational accidents, and 2.34 million die due to occupational injuries and diseases (OIT, 2016). Farm workers are exposed to both tangible and intangible health hazards and researchers have addressed the issues and interventions.

Farming situations present several respiratory hazards to farm workers and exposure to these hazards has been linked to excessive coughing and congestion in many farm workers and families. Nuisance dusts and gases also are hazards. Suspended dust particles not containing spores from moldy organic matter are considered nuisance dusts. Repeated exposure can turn portions of the lung into hardened, non-functioning tissue and cause chronic bronchitis and occupational asthma. A variety of disabling gases, including nitrogen dioxide (NO_2), hydrogen sulfide (H_2S), ammonia (NH_3), Carbon dioxide

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(CO_2), and methane (CH_4), are produced during many routine operations. Exposure to low levels of NO_2, H_2S, or NH_3 will produce lung and eye irritations, dizziness, drowsiness, and headaches. High levels of H_2S, particularly, and NO_2, secondarily, will quickly render a worker unconscious and death will follow. Pandirwar et al (2014) found that, the workers performing threshing are potentially exposed to higher level of dust concentration exceeding the desirable limit. The reparable particles (<2.5 μm) and inhalable particles (<10 μm) concentration in work environment of worker performing the task of harvesting, handling, threshing and collecting grains are exposed to hazardous level of dust concentration. They also found that, the non-woven fabric material had higher filter efficiency (98.70 to96.50%), lower pressure drops (14.17 to 27.67 mm of H_2O) and highest acceptability during the harvesting and threshing operation. Thus, non-woven fabric filter material can be used for personal dust protection of farm workers. The best prevention of respiratory disease is to wear a respirator approved by the National Institute of Occupational Safety and Health (NIOSH) and research organizations. Air-purifying respirators remove contaminants from the air, but can only be used in environments with enough oxygen to sustain life.

Studies have been carried out in the country on thresher accidents and injuries and agricultural accidents in years 1978 to 2009 by researchers (Verma et al., 1978; Ghosh, 1980; Tandon, 1990; Mohan et al., 1992; Mittal et al., 1996; Gite and Kot, 2003, Adarsh et al. 2002 and 2008). The accidents in Indian agriculture were reported 30.5% with farm machinery, 34.2% with hand tools and 35.3% from other sources such as snake bites, animal bites, falls in well/ponds, lightning, heat stroke etc. Out of all, 5.6% were fatal and the overall accident incidence rate was 33.4 accidents per million workers, with a fatality rate of 1.83 at farm power availability of 1.7kW/ha. While in the USA, the fatality rate was 2.6 per million workers in the year 2005 at farm power availability of 4 kW/ha. The data clearly indicates the increase in accident rate with an increase in farm power availability per ha. Presently farm power availability per ha in the country is 2.761 kW (Singh and Singh, 2021).

The accidents also account for economic loss to the country. Based on these findings, many interventions were developed at different places of the country on safety gadgets for sugarcane threshers; conveyor feeding systems for high capacity threshers and chaff cutters; rear overturning protection mechanisms, rear lighting horn systems with turning indicators, brakes with safety features for tractor trailer; safety cover for well/tube well, tractor operated blower for pumping poisonous gas from wells; vibration isolators and personal safety wears to minimize the accidents.

In addition, attempts have been done to reduce occupational health hazards by providing suitable protective wear. Occupational health hazards are physical, chemical, mechanical, biological, psychosocial and ergonomical.

Nayak et al. (2013) conducted a study on 480 households on the involvement of women in different farm, household and livestock activities, possession and use of different household and agricultural tools and equipment, health hazards due to smoke, illumination and noise, fuel consumption, carrying load for collection of fuel, fodder and fetching water, safety practices in their day to day life to prevent minor and major injuries etc. A quantitative assessment of 50 households of 24 main villages on the workplace (cooking stove) was carried out and data were recorded regarding continuous time spent at cooking stove; illumination level during cooking, food preparation, living room & their entrance; temperature, humidity and smoke in kitchen during the cooking meal; time spent in cooking major

food items and daily fuel consumption. They reported occupational risk factors in household activities as per a survey of 480 households which are static position, forward bending, heavy lifting and carrying, kneeling and vibration in agriculture.

An epidemiological study done in North India by Mohan et al. (2004) showed that all age groups sustain fodder cutter machine injuries. More than 45% of the victims were children below 15 years of age. Fodder cutting machines were involved in a significant proportion of limb amputation injuries in the study area. A cost-effective, improved design was developed for the safe operation of the fodder cutter based on ergonomic principles.

Compensation data of agricultural injury victims (156 cases) were collected from the Sonipat District, Haryana, by Kumar and Singh (2016) in India to assess the kind of injuries and disabilities along with machines associated for the years 2008 to 2014. The fodder cutter was the most common machine associated with disabling injury; safety interventions were developed and retrofitted in 50 households and feedback was collected. Total bodily injuries were 105 out of 156 cases, out of which 84 cases (80%) pertained to amputation of fingers, 13 cases involved hand wrist (12%), 5 cases (5%) had a leg injury, one person (1%) injured his eye and four cases (4%) injuries sustained on the upper body. Machines associated with injuries were chaff cutters (74 cases), electric motors (20 cases), tube wells (6 cases), threshers (12 cases), tractor/trolley (9 cases), harrows (2 cases), and one each of reaper, sickle, winnower, and seed drill. The causal factor associated with fodder cutter injuries were; accessibility of children to the machine, getting injured while playfully interacting with this machine; hands injuries while feeding the fodder as entrapped in the rollers; diverted attention; loose clothes, getting entangled in the gears and belt.

Adarsh et al. (1999) effect of whole-body vibrations on degenerative changes in the spine of 50 tractor driving farmers was evaluated by comparing them with a control group of 50 non-tractor driving farmers matched for age, sex, ethnic group, land holding and work routine. All participants were interviewed in detail for the occurrence of low back pain, examined clinically and a magnetic resonance image (MRI) of the lumbar spine region was obtained. Data evaluation revealed that the tractor-driving farmers complained of backache more often than non-tractor-driving farmers, but there was no significant objective difference in clinical or magnetic resonance imaging between the two groups.

Noise exposure is also common with farm equipment and power sources. Adarsh et al. (2005) studied two groups of fifty experienced tractor-driving farmers and fifty non-driving farmers selected from two villages 50 km from Delhi. Both groups were interviewed for details of work routine, assets held, family profile, health problems and noise exposure details to assess the influence of these parameters in producing hearing impairment. An audiogram evaluation of hearing ability was done in all cases. Noise measurements were also performed on tractors and other machines to observe the magnitude of noise levels. Self-reported hearing problems were similar (4 cases each) in both groups of 50 farmers. However, audiogram analysis showed a higher prevalence of abnormalities in tractor-driving farmers. Tractor driving farmers (24) had more often high-frequency hearing loss when compared to non-tractor driving farmers (14). The noise levels observed on tractors in different operations ranged from 90 to 110 dB (A). It was concluded that tractor noise levels exceeded the recommended safe limits of OSHA and NIOSH prescribed standards. Tractor-driving farmers had higher high-frequency

hearing loss than non-tractor-driving farmers. The mechanism of damage and prevention needs to be studied further.

Conclusions

Most small farmers (less than 2ha holdings) do subsistence farming; hence, compensation for victims of farm accidents has been provided by some of the states, but a uniform policy is needed in the country. There is a need to develop a mechanism for regular monitoring of accidents and occupational health issues in agriculture.

The application of ergonomics plays a very important role in reducing accidents/ injury by providing suitable gadgets and also helps in developing safety guidelines/ good practices documentation for various operations/areas in agriculture. Conducting nationwide training programs on farm safety will also be helpful in this regard by creating awareness amongst farmers, farm workers, extension officials and other stakeholders.

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