Agricultural sector in India – OSH Perspective

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ERGONOMICS
Study of relationship between a person and his/her working environment
Agricultural sector in India – Occupational Safety and Health Perspective

• Indian agriculture- Overall scenario
• Issues involved
• Technological solutions
• Legal and social aspects/schemes related to agricultural workers
• ILO conventions with respect to agriculture
• Challenges in improving OSH in agriculture in India
• Priorities and recommendations for improving OSH in agriculture in India

DG Agricultural Safety
Importance of Agriculture to National Economy

• The contribution of agriculture and allied sectors in national GDP is about 14%.
• About 52% of the Indian work force depends on agriculture for its livelihood.
• Agricultural export constitutes 10 per cent of the country’s exports
• Annual sales of farm machinery is about Rs. 50,000 crore.

Agriculture includes animal husbandry, dairy, as well as fisheries sectors.
Indian Agriculture

Total geographical area - 328 million ha
Net cultivated area - 140 million ha
Yearly production – food grains - 257 million tonnes
  Fruits - 81 million tonnes
  Vegetables - 163 million tonnes
No. of land holdings - 120 million
Average size of land holding - 1.16 ha
Agricultural workers - 263 million

Of these 37% are female workers

Contribution of human power to the total power used in agriculture is about 5%.

Agricultural machinery population -150 million
(Tractors & Self propelled machines -5.4 million
Hand tools -400 million.)
### Population Dynamics of Indian Agricultural Workers

(No. in million)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>2011</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Country’s Population</td>
<td>1210</td>
<td>1323</td>
<td>1612</td>
</tr>
<tr>
<td>2.</td>
<td>Total no. of Workers</td>
<td>482</td>
<td>566</td>
<td>693</td>
</tr>
<tr>
<td>3.</td>
<td>No. of workers as % of population</td>
<td>40</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>4.</td>
<td>No. of agricultural workers</td>
<td>263</td>
<td>230</td>
<td>202</td>
</tr>
<tr>
<td>5.</td>
<td>% of agricultural workers to total workers</td>
<td>55</td>
<td>41</td>
<td>26</td>
</tr>
<tr>
<td>6.</td>
<td>a) No. of male agricultural workers</td>
<td>165</td>
<td>120</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>b) No. of female agricultural workers</td>
<td>98</td>
<td>110</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>c) % of females in agril. work force</td>
<td>37</td>
<td>45</td>
<td>50</td>
</tr>
</tbody>
</table>
Indian Agriculture

- No. of Agricultural workers : 263 million
  No of Farmers : 144 million
  No of Labourers : 119 million

- Of the total farmers, about 84% are small and marginal farmers (having less than 2 ha land).

- Draught animals : 50 million

- Tractors and self propelled equipment : 5.4 million
- Electric motors/pumpsets : 17 million
- Diesel engines : 9 million
VARIABILITY IN INDIAN AGRICULTURE

- Cropping patterns are different.
- Agricultural practices vary depending on the crops.
- Level of mechanization varies.
  - (Tractor density 0.1 to 98/1000 ha.)
- Type of equipment used differ depending on the power source used.
- Horticultural crops, Plantation crops, sericulture have different requirements.
Workers in Indian Agriculture

Upland cultivation

Wetland cultivation

Horticulture

Hill agriculture

Worker as a source of power

Worker as a machine operator
Agricultural accidents Studies

- Verma et al. (1978) – Thresher accidents in Punjab
- Ghosh (1981) - Thresher injuries around Delhi
- Tandon (1988)- Agricultural accidents around Delhi
- Mohan et al. (1992)- Agricultural accidents in Haryana
- Mittal et al. (1996)- Agricultural accidents in Punjab
- Gite and Kot (2003)- Accidents survey in Indian agriculture in four states
- Gite et al. (2009) - Agricultural accident survey based on large sample of villages in seven states
Accidents in Indian Agriculture

<table>
<thead>
<tr>
<th>Source</th>
<th>% of total accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm machinery</td>
<td>30.5</td>
</tr>
<tr>
<td>Hand tools</td>
<td>34.2</td>
</tr>
<tr>
<td>Other sources</td>
<td>35.3</td>
</tr>
<tr>
<td>(snake bites, animal bites,</td>
<td></td>
</tr>
<tr>
<td>fall in well/pond,</td>
<td></td>
</tr>
<tr>
<td>lightning, heat stroke etc.)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Fatal accidents - 5.6%,
Non-fatal accidents - 94.4%
Overall accident incidence rate - 334 accidents/100,000 Workers/Year
Fatality rate - 18.3/100,000 workers/Year
Fatality rate due to agril. accidents in US
- 24.0 per 100,000 workers in 1980
- 26.0 per 100,000 workers in 2005
  Farm power availability : 4 kw/ha

Fatality rate due to agril. accidents in India
- 18.3 per lakh workers
  Farm power availability at present : 1.7 kw/ha
  It will increase to 3.5 kW/ha in 2050

Fatalities in Indian agri. -11.4/lakh workers/kw farm power
Fatalities in US agriculture - 6.5/ lakh workers/kW farm power
Accident estimates for Indian Agriculture

It is estimated that in India every year there might be about 7.6 lakh accidents in agriculture resulting in deaths of about 45,000 workers and injuries to others. The economic loss to the country is estimated at about Rs. 5400 crores.

- Everyday, there are 2080 accidents in agriculture.
- Everyday, there are 120 fatalities in agriculture.
- Everyday, our country looses Rs. 15 Crore due to these accidents.
## Details of Farm machinery accidents

<table>
<thead>
<tr>
<th>Source</th>
<th>% of total accidents</th>
<th>Accident incidence rate No./1000 machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor &amp; tractor operated implements</td>
<td>31</td>
<td>3.0</td>
</tr>
<tr>
<td>Threshers (Including winnowers)</td>
<td>14</td>
<td>10.6</td>
</tr>
<tr>
<td>Chaff cutters (Manual + power operated)</td>
<td>9</td>
<td>1.3</td>
</tr>
<tr>
<td>Sprayers (Manual + power sprayers)</td>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>Cane crushers</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Electric motors/ pump sets</td>
<td>12</td>
<td>1.0</td>
</tr>
<tr>
<td>Power tillers</td>
<td>6</td>
<td>19.9</td>
</tr>
<tr>
<td>Animal drawn equipment</td>
<td>22</td>
<td>1.0</td>
</tr>
<tr>
<td>Other equipment</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>
Major equipment involved in accidents
Tractor accidents
Thresher accidents
Chaff cutter accidents
Safety gadgets for farm machines/activities

- Safety gadgets for chaff cutters and sugarcane crushers
- Conveyor feeding system for high capacity thresher
- Conveyor feeding system for power operated chaff cutter
- Rear overturning protection mechanism for tractor trailer
- Rear lighting system with turning indicators for tractor trailer
- A tractor trailer with brakes and other safety features
- A safety cover for well/ tube well
- Tractor operated blower for pumping poisonous gas from wells
- Vibration isolators for tea pruner
- Personal safety wears for hill area workers
• Tractor with ROPS

• TNAU Safe tractor trailer (cost of safety features Rs. 50,000/- out of trailer cost of Rs. 2.0 lakh)

• Safe thresher with conveyor for feeding
Safety devices for manual and power operated chaff cutters

IS: 7898-2001 Manually operated chaff cutter- Specifications

IS: 15542-2005 Power operated chaff cutter- Safety requirements
Occupational Health Aspects

- Health issues due to Excess Vibrations Dose
- Noise Exposure Problem
- Respiratory Diseases due to dust
- Chemical Exposure ill Effect due to pesticides spray
- Musculoskeletal disorders
- Extreme weather conditions

Personal protective wears are needed.
Adoption of these devices will become necessary.
Tractors and Self propelled Equipments
Fatigue decreased proficiency limits for whole-body vibration (ISO 2631)

<table>
<thead>
<tr>
<th>Exposure time, normal workday, h</th>
<th>Acceleration, m/s$^2$ rms</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical z axis</td>
<td>Horizontal x and y axis</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.315</td>
<td>0.224</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.400</td>
<td>0.285</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.530</td>
<td>0.355</td>
<td></td>
</tr>
</tbody>
</table>
Limits of frequency-weighted hand-arm accelerations {ISO 5349 (1986)}

<table>
<thead>
<tr>
<th>Exposure time, normal workday, h</th>
<th>Acceleration, m/s² rms x, y and z axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2.1</td>
</tr>
<tr>
<td>4</td>
<td>2.9</td>
</tr>
<tr>
<td>2</td>
<td>4.1</td>
</tr>
<tr>
<td>1</td>
<td>5.8</td>
</tr>
</tbody>
</table>
Improved tractor seat suspension using Piezoelectric material based vibration isolators

- A new seat suspension system was designed using the piezoelectric material based vibration isolator
- It was installed between tractor seat axle casing for vibration isolation.
- This seat suspension system could reduce the vibration acceleration values by 20 to 50% at different speeds in road transport and field operations.
Tractor drivers face hearing loss problem

- Mean audiometric threshold values of both the ears were the higher than 25 dB(A) at 3, 4, 6 & 8 kHz frequency for tractor drivers whereas it didn’t exceed the 25 dB(A) in case of office workers.

- The tractor drivers should use personal protective devices such as ear plugs, ear muffs etc. while operating tractor in fields.

- The tractor manufactures need to design tractors with lesser noise levels.

- Exposure limit – 90 dB for 8 h work duration
Reducing dust exposure of workers in Rice mills

Before modification
Dust concentration
77 mg/m³ of air

After modification
Dust concentration
< 10 mg/m³ of air
Health Hazards due to pesticides
TNAU Spraying safety kit

- It consists of
  - a face mask, a pair of hand gloves, an eye protector, and an apron.

- Efficient spraying safety kit having pesticide arresting efficiency of about 75% has been developed.
Anthropometric & strength data of agricultural workers

- Data on 79 body dimensions for 12525 agricultural workers and strength data on 16 parameters for 5937 workers.

- Data are being used in design of hand tools, farm machines, tractors etc.
## Indian Agricultural workers – Anthropometric & strength data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean values</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>Height, cm</td>
<td>163.3</td>
<td>151.5</td>
<td></td>
</tr>
<tr>
<td>Weight, kg</td>
<td>54.7</td>
<td>46.3</td>
<td></td>
</tr>
<tr>
<td>Push force with both hands (standing), N</td>
<td>224</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>Pull force with both hands (standing), N</td>
<td>218</td>
<td>158</td>
<td></td>
</tr>
</tbody>
</table>
Occupational hazards in cashewnut units

Effect of CNS liquid on hands during cashewnut processing

Latex gloves can protect hands and help to have higher work capacity
Occupational health issues of women workers in fish processing activities
Occupational health issues of women workers in fish processing activities

- The average capacity of dressing of fish without gloves was observed to be 36.7 kg/h.
- The highest capacity was 42.4 kg/h while using gloves.
LEGISLATIONS RELATING TO OCCUPATIONAL SAFETY AND HEALTH IN INDIA

4. The Plantation Labour Act, 1951
5. The Shop & Establishments Act.
10. The Indian Boilers Act, 1923 and the Indian Boilers Regulations.
11. The Dangerous Machines (Regulation) Act, 1983.
A proposal for revision of DMRA 1983 submitted to DOAC to make the act more pragmatic and effective.
Dangerous Machine (Regulation) Act 1983

Compensation for victims of agricultural accidents

• A model proposal for compensation prepared

• Some states have started compensation schemes for agricultural accident victims
Compensation schemes for Agricultural accident victims

- Schemes operated by State Agricultural Marketing Boards in Punjab and Haryana
- Krishak Saathi Yojna in Rajasthan
- Khatedar Khedut Aksmik Mruitu/ Apangata Sahay Yojna in Gujarat
- Farmers Janta Accident Insurance Scheme in Maharashtra
- Farmers Janta Accident Insurance Scheme in Uttar Pradesh
- Krishak Kalyan Yojna in Madhya Pradesh
Yearly Compensation paid to accidents victims in Agriculture

- Punjab : Rs. 8 crore
- Haryana : Rs. 4 crore
- Rajasthan : Rs. 14 crore
- Maharashtra : Rs. 8 crore

For other states data are not readily available. It is estimated that each year about Rs. **100 crore** are paid towards compensation through various schemes running in different states.
<table>
<thead>
<tr>
<th>Description</th>
<th>Compensation Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>In case of death</td>
<td>Rs. 1,00,000/- to 2,00,000/-</td>
</tr>
<tr>
<td>Amputation of one body part/one body part rendered useless viz. hand, arm, leg, eye, foot etc./any other serious injury.</td>
<td>Rs. 30,000/- to 40,000/-</td>
</tr>
<tr>
<td>Amputation two body parts/two body parts rendered useless viz. hand, arm, leg, eye, foot etc./any other serious injury.</td>
<td>Rs. 45,000/- to 60,000/-</td>
</tr>
<tr>
<td>Amputation of one finger (finger parts will be equivalent to amputation of complete finger.)</td>
<td>Rs. 7,500/- to 10,000/-</td>
</tr>
<tr>
<td>Amputation of three fingers</td>
<td>Rs. 22,500/- to 30,000/-</td>
</tr>
<tr>
<td>Amputation of four fingers (equivalent to amputation of one body part)</td>
<td>Rs. 30,000/- to 40,000/-</td>
</tr>
</tbody>
</table>
ILO conventions concerning safety and health of workers

- C155 Occupational Safety and Health Convention, 1981
- C184 Safety and Health in Agriculture Convention, 2001
- C185 Seafarers' Identity Documents Convention (Revised), 2003
- C188 Work in Fishing Convention, 2007
- C189 Domestic Workers Convention, 2011
Safety and Health in Agriculture

ILO Convention No. 155 deals with the Occupational Safety and Health Aspects of workers in all branches of economic activity.

ILO Convention No. 184 specifically deals with Safety and Health in Agriculture.
ILO Convention No. 184 concerning safety & Health in Agriculture

Here, the term agriculture covers agricultural and forestry activities carried out in agricultural undertaking including crop production, forestry activities, animal husbandry and insect raising, the primary processing of agricultural and animal products by or on behalf of the operator of the undertaking as well as the use and maintenance of machinery, equipment, appliances, tools, and agricultural installations, including any process storage, operation or transportation in an agricultural undertaking which are directly related to agricultural production.

However, here, the agriculture does not cover:

- subsistence farming;
- Industrial processes that use agricultural products as raw material and the related services;
- and the industrial exploitation of forests.

In India, about 84% of the farmers are in small and marginal category (having less than 2 ha size). These farmers basically follow subsistence farming. As per ILO Convention 184, the subsistence farming is not covered under ILO Convention.
ILO Convention No. 184 concerning safety & Health in Agriculture-
Recommendations of DGFASLI

• To take care of this convention, it was suggested to rename The Plantation Labour Act, 1951 as the Agriculture Workers (Safety, Health and Welfare) Act. In Plantation Act 5 ha is the size above which this act is applicable.
Challenges in improving OSH in agriculture in India

• Most of the workers in agriculture are in unorganized sector.
• Agriculture is a state subject and therefore the central government gives guidance and assistance to the states.

• The responsibility of implementation of any programme rests with the state governments.

• Every year, the fatal accidents reported from industries are less than 1000.

• In agriculture there are more number of accidents and fatalities than that of industry. However, there is no mechanism to monitor these accidents.

• Of the total farmers, about 84% are small and marginal farmers (having less than 2 ha land). Most of them do subsistence farming.
Priorities and recommendations for improving OSH in agriculture in India

• Developing a mechanism for regular monitoring of accidents and occupational health issues in agriculture.
• Designing tractors and other farm machines keeping ergonomics and safety aspects in consideration.
• Developing suitable personal protective wears for use during hazardous farm operations.
• Provision of hydraulic/pneumatic brakes, slow moving vehicle symbols and other safety provisions on tractor trailers.
• Making safety gadgets mandatory on various farm machines (such as ROPS for tractors, safe feeding devices and power transmission systems on threshers and chaff cutters, spraying safety kit during pesticide application, earmuffs for protection from noise).
• Developing safety guidelines/ good practices documentation for various operations/ areas in agriculture.
• Conducting nationwide training programmes on farm safety to create awareness amongst farmers, farm workers, extension officials and other stakeholders.
OHS Delivery System

- At present, in India there are two Directorates for workers’ safety:
  - DGFASLI located at Mumbai
  - DGMS located at Dhanbad.
- The DGFASLI caters the needs of industrial and dock workers whereas the DGMS is exclusively devoted to workers in mines and oilfields.
- The total number of workers in these sectors is about 30 million.
- The annual budget of DGFASLI and DGMS is about Rs 1000 million.
- Therefore, it is a high time that a suitable administrative mechanism is established at national level to take care of safety and health issues for 263 million agricultural workers.
- It can be the “Directorate General of Agricultural Safety”
Our Goal

• Increasing productivity of workers without jeopardizing their health and safety in various operations in agriculture and allied activities.

• Reducing drudgery,

• Inclusive growth in agriculture thereby making the agricultural workers as partners in development process.

All India Coordinated Research project on Ergonomics and Safety in Agriculture
Jaan Hai To Jahaan Hai

Thanks