

Title- Pattern of agricultural injuries and their economic impact on the affected families in Ratlam districts, Central India

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Objectives:

1. To spell out the man and machine variables involved in agricultural accidents
2. To estimate its socio-economic impact on families affected due to agricultural injuries in Ratlam district

Abstract

Introduction: In India, agriculture contributed significantly to economy of Country. As per census 2011, total no. of agricultural worker found to be 236 million.^[2] In report of safe work Australia revealed that over eight year 328 death occurred due to agricultural injuries, out of which 92% death were reported in males and 8% were reported among females.^[22]

Due to non availability of adequate data of agricultural accidents it becomes difficult to calculate financial burden of these risks and to identify the pathways and means to mitigate them.

Methodology: An observational cross sectional study conducted after getting ethical approval from ethical committee in villages of Ratlam District selected by stratified random sampling method for the duration of one year. Data collected by using predesigned structured proforma through selected villages using key informant approach. Study financially supported by Indian Council of Social Science Research (ICSSR).

Discussion: In our study most of agricultural accidents during agricultural activities due to Hand tools related accidents (433) followed by other accidents such as drowning, animal and snake bites etc.(164), and agricultural machinery (147). Most of the fatal injuries reported mainly due to other accidents (135) followed by agricultural machinery (95) related accidents and field related

work (57). **Conclusion:** Agricultural accidents responsible for fatal and non-fatal injuries which results in financial loss not only to the family of victims but also to community, state or country.

Keywords: Agricultural injuries, economic impact, fatal and non-fatal injuries, hand tool, agricultural machinery.

Introduction:

In India, agriculture contributed significantly to economy of Country. In India agriculture is a field where all family members including children and labors deployed, involved in various work related to agriculture. Thus all the members involved directly or indirectly have equal risk of agricultural injury irrespective of their age and sex.^[1] As per census 2011, total no. of agricultural worker found to be 236 million.^[2] It was estimated that in 2020, about 45% female workers contributed to total agricultural workers.^[3] Various Studies conducted in developed countries related to agricultural injuries/accidents.^[4-9]

Most common agricultural injury found to be tractor overturned due to lack of Rollover Protective Structure (ROPS).^[10-14] Agricultural injury related to tractors mainly due to rollovers, hitching equipment, power take offs, tractor operations, falls from tractors and towing (Abubakar et al.^[12] A study conducted in Poland reported 27.5% deaths by traffic accidents followed by hit, crushed by falling objects and materials.^[8] An Italian study compare fatality due to tractor rollover accidents were 43.7% as per Surveillance System and 10.6% as per Operational Archives records.^[14] A study conducted in Punjab reported injuries related to thresher may be due several factors such as human, machine and others factors which contributes 73%, 13% and 14%, respectively.^[15] A study conducted in Finland by Mattila et al.^[16] reported that merely fall, slip or trip contributed to about 45% of total injuries and nature of injuries were non-fatal. The study conducted by Kumar et al.^[17] it was reported that most of the injuries were caused to the foot and legs due to slippage of tool from hand or hitting a hard surface.

A study conducted by kumar P et al.^[18] regarding agricultural accidents during year 2000 to 2005 in villages under four districts of Arunachal Pradesh found that rate of incident were 6.6/1000 workers/year, of which farm implements about 40% of accidents and about 30% workers suffered was belongs to age group of 40-49 years of age. In another similar study of Patel et al.^[19] conducted in Arunachal Pradesh mentioned that rate of incident were 589/1,00,000 workers per year because of hand tools. So, to reduce the incidents related to agriculture, during designing and development, anthropometric measurement of body of user group should be considered.^[19,20,21]

The main cause of agricultural incidents is improper design of operator's workplace, improper design of tools/equipment, lack of knowledge/training, ignorance, tiredness, etc. Agricultural injuries may lead to death of the worker. In report of safe work Australia revealed that over eight year 328 death occurred due to agricultural injuries, out of which 92% death were reported in males and 8% were reported among females.^[22]

The use of agricultural machinery have increased the production of Indian agriculture. But, the other side increases the risk of agricultural accidents. A injury or a loss of a family member due to

agricultural accidents gives a big financial loss not only to the family but to the whole state and family becomes in trouble if the lost family member is only earning member of the family.

Due to non availability of adequate data of agricultural accidents, it becomes difficult to calculate financial burden of these risks and to identify the pathways and means to mitigate them. This study was conducted in tribal district of Madhya Pradesh to gather the data related to agricultural work related injuries both fatal and non-fatal, which helps the government to develop effective policy to reduce burden of agricultural related injuries and provide social security to the family members of agricultural workers.

Methodology:

Definition of Agricultural Accident: An agricultural accident is defined as any destructive event that occurs suddenly or by an accident that results in hazards, death, property damage, damage of time and apparent loss due to farm equipment (Adamade 2007).^[23] They explained that an agricultural accident may be occurs during field work. Farmers who are using the agricultural equipments have to perform many tasks and have to take decisions for machines for working properly. Seeking multiple decisions can lead to errors and raise risks (Kepper et al., 1980)^[24] Severity of injuries assessed by using Abbreviated Injury Scale(AIS) . AIS is based on anatomy and expert consensus results- designed to classify injuries according to body region on an ordinal scale ranging from AIS 0 to AIS 6, classify the severity as AIS 0 – there is nil injury, AIS 1- minor (it is not required professional treatment), AIS 2 - moderate (Require some professional treatment and not life threatening.), AIS 3 - serious (It requires hospitalization it is also normally not life- threatening), AIS 4 - severe (life threatening but survival is possible), AIS 5 - critical (requires critical care; survival unexpected), AIS 6 - maximum (untreatable) .

Types of study: Observational cross-sectional study

Duration of study: Data were collected for last one year (2019-20) on recall basis.

Selection of villages in the region: The district was selected on the basis of data available with the agricultural department of state government. It is basically selected with the fact that the district which have high tractor density. The tractor density is the one of the best measure intensity of mechanization in the region. The Ratlam district has a tractor density of 15 tractors/1000 hactre. Villages were selected through Stratified Random Sampling technique. The Ratlam district have eight blocks 1016 villages. For this, we treat all eight blocks as strata and select 10 villages from each stratum to get 80 representative villages of the region. It is proposed to collect the data through selected villages using key informant approach.

Inclusion/Exclusion criteria: Those who gave consent for being the part of the study were included and those not gave consent were excluded.

Identification of Key informants and establishing contacts with them: Contacts was established with key informants viz. Sarpanch, Gram Sevak, Agril. Extension Officer, Doctors of health centres etc. in the selected villages through the Directorate of Agriculture/Revenue authorities.

Survey programme: The selected village was visited by the researcher and officials of agriculture department informants, information on socio-economic-demographic and agricultural accidents related aspects was collected using the predesigned structured proforma.

Analysis of data: At the end of the survey, the collected data analyzed by using MS excel and Epi info-7.2.5.0. and based on the finding, estimated data calculated for the broad area.

Financial support: By Indian Council of Social Science Research (ICSSR)

Ethical approval: Ethical approval taken from ethical committee

Results:

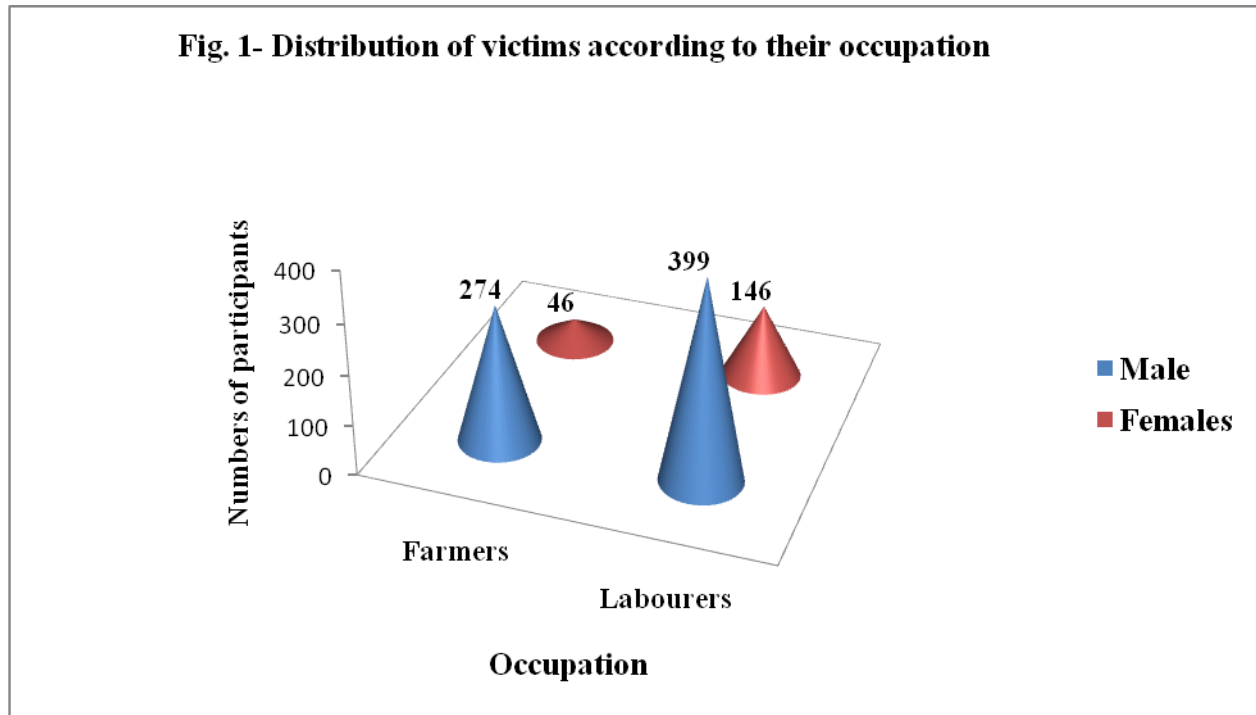


Table-1: Severity-wise agricultural accidents reported in the studied villages during the one year period

S. No.	Severity	AIS 0	AIS 1	AIS 2	AIS 3	AIS 4	AIS 5	AIS 6	Total
1	Fatal	0	0	0	0	0	0	296	296
2	Non-Fatal	0	1	464	60	35	9	0	569
Total		0	1	464	60	35	9	296	865

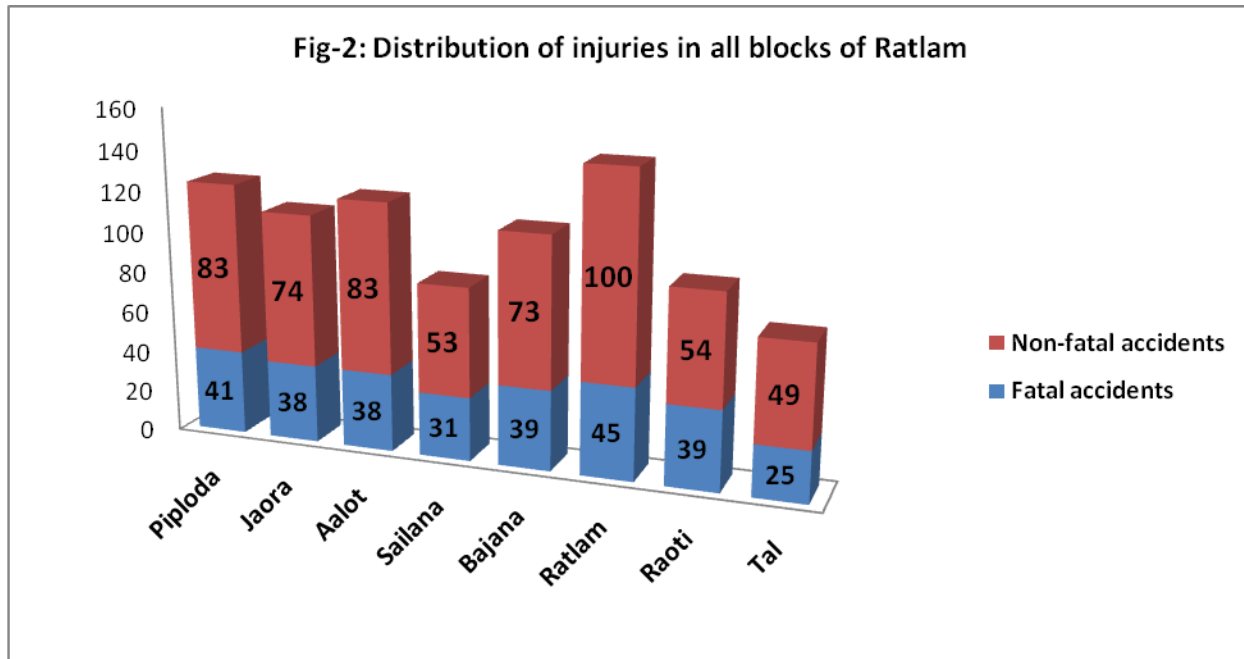


Table-2a: Distribution of type of agricultural accidents among the victims

S. No.	Category of accidents	Type of accidents among victims		
		Fatal	Non fatal	Total
1.	Agricultural Machinery (Tractors, Threshers, power tillers, sprayers/chemicals etc.)	95	52	147
2.	Agricultural hand tools (Sickles, Hand hoes etc)	0	433	433
3.	Field Work (Sleeping, skidding, falling, electric shock etc.)	57	48	105
4.	Natural Disaster (Electrocution, Flood etc.)	9	7	16
5.	Others (animal, snake bites, drowning etc.)	135	29	164
Total		296	569	865

Table-2b: No. of estimated injuries among agriculture workers in Madhya Pradesh for the year 2020

S. No.	Category of accidents	Number of estimated injuries		
		Fatal	Non-Fatal	Total
1.	Agricultural Machinery	4823	2623	7446
2.	Hand tools	-	423852	423852
3.	Others (field work, Natural disaster, snake bites, animal bites/hit etc.)	196950	82225	279175
Total		201773	508700	710473

Table-3: Assessment of time loss of the victims in during the one year period

S. No.	Time loss	Total
1	2 to 15 days	436
2	16 to 30 days	102
3	31 to 45 days	11
4	Above 46 days	20
Total No. of Victims		569

Table no. 4: Assessment of financial loss (medical) of the victims after accidents in one year

S. No.	Financial loss (Medical)	Total
1	Rs. 1000-5000	376
2	Rs. 6000-15000	150
3	Rs. 16000-25000	28
4	Above Rs. 26000	15
Total No. of Victims		569

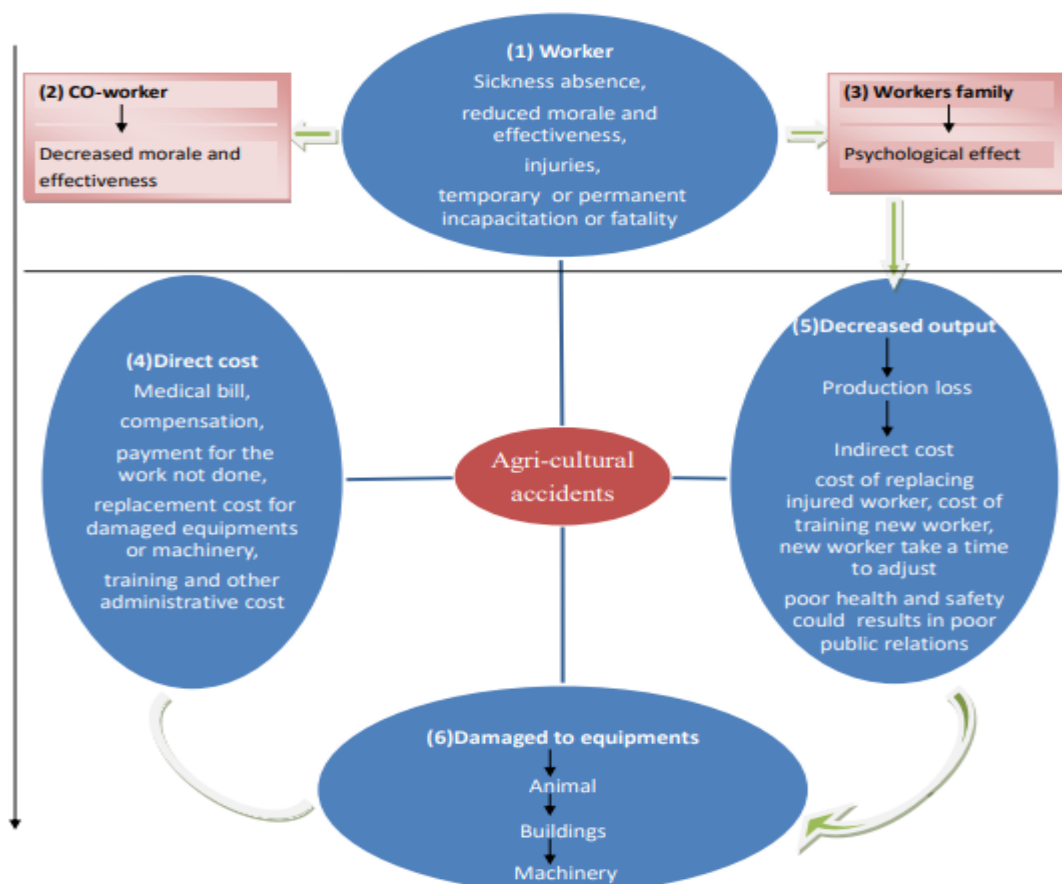


Fig. 3 Effects of agricultural accidents

Discussion:

In our study, the classification of accident victims according to their work status. In the agricultural sector the majority of work is labour dependant and it is shown in the present study where the farmer contributes around 37% and rest by the agricultural labors. Verma et al.^[15] also explained most of (70%) of agricultural workers got injuries while indulged in agricultural activities. It may be case that the risk work in agriculture is mostly done by the laborers only. The $\chi^2 = 235.98$; $p < 0.001$ of farmers and laborers victims i.e. they are statistically significant. The basic reason for this is that, maximum farmers in Madhya Pradesh employs the workers for the usage of their agricultural machines. Farmers engaged in activities such as planting / replanting, weeding and harvesting mainly with hand tools. If we analyze the sex wise data of accidents victims, it reflects that the female's role in agricultural is different than males. The women victims of agricultural accidents contribute around 22% and rest by the male. In rural India, women contributed a lot in agriculture and provide important support to household livelihood. Although they contribute significantly to household income, the works they perform go unacknowledged. Their role in agriculture and allied activities is confined to as a worker or laborer (physical work), which involves a lot of drudgery. Improved tools/implements available are mainly used by the male farmers and farm women are left to use traditional tools and procedures for carrying out various field operations resulting in low system efficiency and high drudgery. The $\chi^2 = 123.65$; $p < 0.001$ of male and female victims i.e. they are statistically significant.

Among the source-wise accidents, the major contribution in accidents was with Hand tools related accidents (433) followed by other accidents (164), field related accidents (105) and agricultural machinery (147) and so on. The machinery includes like tractors, self propelled machines, threshers, chaff cutters electric pumps, chemicals etc. As mechanization increases, these types of accidents increases. This directly reflects that one has to take human into account first. At present we are constricting on high level of development without any significant safety measures in machines. Tractors are most dangerous machinery in this regard then self propelled machines like harvester, threshers contributes a lot, electric motors, chaff cutters, sprayers causes much of accidents. Hand tool related accidents are generally non-fatal in nature. A small cut may cause one month absent from work of a farmer. According to the definition of present study we are taking two or more than two days loss but there were no accidents found which costs less than seven days absent. Accident during field work may include off farm and on farm activities. In natural disaster the main causes are electrocution and flood. Simple awareness tools can save many lives. Other accidents includes snake or scorpion bites that are very common and other animal bites. As for as type of event of involved in accidents is concern majority of accidents were cut event followed by falling, sleeping while working, entanglement of garments in different parts of machines, entanglements of body parts in machines, roll-down of tractors, skidding, jerks, snake/scorpion bites etc. Most of the fatal accidents reported mainly due to agricultural machinery (11%) and other accidents like animal, snake bite, drowning etc (15.6%). Agricultural machinery related injuries which were also reported by some investigators (Mittal et al.^[25]; Lakhtakia et

al.,^[26], Patel et al.^[27], Tiwari et al.^[28]). Another study revealed that snake bite also responsible for the deaths of agriculture worker.^[29]

To estimate the number of agricultural machinery related accidents, the rate of incidents calculated is based on the total number of agricultural machinery-related accidents and the total number of agricultural machinery prone to accidents in eighty villages. The level of accidents is multiplied by the total number of hazardous agricultural machinery in Madhya Pradesh region by 2020 to determine the total number of accidents associated with farm machinery. Data from the 2016 Live Stock Census has been updated using the annual growth rate of 10% of the number of hazardous agricultural machinery mentioned in table no. 2b (excluding loggers, blacksmiths, winners, animal-fired sugarcane burners and diesel pumping censuses for the 2016 census. Data were taken as such in 2016 with the olpad thresher when taking into account 10% per annum acquisition) acquisition of agricultural equipment by 2020. In our study, incidents among agricultural workers found to be 26.11 accidents/1000 workers/year, incidents during the year due to agricultural machinery (Number of accident prone agricultural machines in eighty villages = 82711) found to be 1.77 accidents/1000 agricultural machines/year (incidents of fatal and non-fatal accidents= 1.14, 0.62 accidents/1000 machines/year), incidents during the year due to hand tools (Number of hand tools in eighty surveyed villages = 163589) found to be 2.64 accidents/1000 hand tools/year. Incidents among the workers (no. of workers= 33134) engaged in agricultural activities due to others agricultural accidents category (field work, natural disaster, snake bites, drowning etc.) found to be 8.60 accidents/1000 workers/year.

No. of accident prone agricultural machines in M. P. for the year 2020 (Estimated) = 4230951

Estimated number of machinery related accidents/year in M. P. for year 2020

$$= (1.77 \times 4230951) / 1000 = 7520 \text{ accidents/1000 agricultural machines/year}$$

Number of machinery related fatal accidents/year in M. P. (Estimated)

$$= (1.14 \times 4230951) / 1000 = 4823 \text{ accidents/1000 agricultural machines/year}$$

Number of machinery related non-fatal accidents/year in M. P. (Estimated)

$$= (0.62 \times 4230951) / 1000 = 2623 \text{ accidents/1000 agricultural machines /year}$$

Number of hand tools per worker in surveyed villages = $163589 / 33134 = 4.94$

Estimated population of agricultural workers in Madhya Pradesh for the year 2020 = **3, 25, 00,000**

Estimated number of hand tools in Madhya Pradesh for the year 2020 = 4.94×32500000

$$= 160550000$$

Estimated number of hand tool related accidents per year in M. P. = $(2.64 \times 160550000) / 1000$

$$= 423,852 \text{ accidents/1000 hand tools/year}$$

All hand tool related accidents are of non-fatal nature.

Estimated population of agricultural workers in Madhya Pradesh for the year 2020

$$= 3,25,00,000$$

Estimated number of fatal accidents under others agricultural accidents category

$$= (6.06 \times 32500000) / 1000 = 196,950 \text{ accidents/1000 workers/year}$$

Estimated number of non-fatal accidents under this category = $(2.53 \times 32500000) / 1000$

$$= 82,225 \text{ accidents/1000 workers/year}$$

Investigators and policymakers had problem of determining the cost of life, or in the event of an accidental death, the cost of life lost prematurely. However, such data is needed to develop risk management programs. In this connection scientists come out with average life expectancy (YPLL). This is calculated from the productive age of 65 years. And thus calculated by removing the age at which a person dies. In India normally up to the age of 65 years people work in the farm activities.

To calculate the years of potential life lost (YPLL), mean age of the victims were calculated of the fatal accidents from the studied villages which works out to 35 years and the total productive life span was taken as 65 years. Thus the mean value of years of potential life lost (YPLL) would be 30 years. The number of days in a year a person got employment is 290 days per year (GOI, 2015). Considering the average wages per day as Rs. 162.00, the total cost of one life lost would be about Rs. 17.50 lakhs. Taking these points into consideration the total value of lives lost due to agricultural accidents have been estimated as follows:

Number of accidental deaths in agriculture per year in M.P. = **201773**

Monetary loss per year in M.P. due to accidental deaths = 201773 x 1750000

= **Rs. 353102.75 crores**

According to Dr. Pollock^[30] of Australian Centre for Agricultural Health and Safety; He revealed from his research that farm-related injury deaths cost the Australian economy \$651 million (2008 dollars) in the four years from 2001–2004. He further explained “The figure of \$651 million equates to 2.7% of the 2008 farm gross domestic product (GDP), however this is a conservative estimate, as there are many other costs of a farm injury death that are unquantifiable, such as grief, emotional loss, pain and suffering. Meanwhile, other costs lack readily available and accurate data sources, for example, loss of farm production, production delays, machinery or equipment damage, insurance, taxation and community losses,” the researcher added “If you add also the costs of long-term, permanent injuries and serious injuries requiring hospitalization, the true cost of farm-related deaths and injuries to the Australian economy would be considerably higher”. If the cost burden could be so evident in a developed country what would the case be in a developing country? According to Robert McKee, Chairman Conoco (UK) Ltd.^[31] In his opinion “Safety is, without doubt, the most crucial investment.

Conclusions: In our study most of agricultural accidents during agricultural activities due to Hand tools related accidents (433) followed by other accidents such as drowning, animal and snake bites etc.(164), agricultural machinery such as tractors, threshers, power tillers, sprayers/chemicals etc. (147) and field related accidents like due to sleeping, skidding, falling, electric shock etc. (105) and. Most of the fatal injuries reported mainly due to other accidents (135) followed by agricultural machinery (95) related accidents and field related work (57). As a results of agricultural accidents, families of agricultural workers suffered economic loss in the form of loss of daily wedges, expenses to got treatments after injuries and most dreaded one was loss of premature life, if calculated in the form of monetary loss, found to be Rs. 353102.75 crores per year in Madhya Pradesh only.

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