INTRODUCTION

CHAPTER I

INTRODUCTION

The advent of agriculture marked the beginning of settled life. Human civilizations took root. Agriculture has been rightly termed as 'the mother of all industries and the maintainer of human life which stands at the need of all sciences and arts, indeed, at the head of civilization and progress (Mirdha, 1964). In today's scenario, agriculture has a pivotal role to play in the growth and development of each and every country. More people gain their livelihoods through agriculture than any other industry. In India, an industrially developing country, agriculture contributes a share of nearly 27 per cent to gross domestic product (Alam and Singh, 2003), thus is a concrete pillar of support to economy of the country. Around 70 per cent of the population earns their livelihood from agriculture (E1U, 1997). This brings out the tremendous importance which agriculture holds for India. The workforce estimated at more than 200 million is engaged in agricultural and allied activities to make this sector of economy a huge success. Both men and women carry out numerous field operations to feed the population. Not surprisingly, then, agriculture is one of the most labour intensive and energy demanding occupations. Agricultural operations are difficult, demand a lot of hard work, and much of the power needed for accomplishing these operations is derived from human energy. They are accompanied by difficult postures, and long working hours. Farmers work throughout the year irrespective of the harsh and adverse environmental conditions, under hot sun and in cold weather.

1.1 Role of Women in Agriculture: Agriculture is considered the biggest unorganized sector where a large number of rural women actively participate. Agriculture and allied industrial sectors employ as much as 89.5 per cent of the total female labour (CSO, 1995). Women in rural areas help to grow at least about 50 per cent of the world's food (Reddi and Reddy, 2003). From various research studies conducted in the country to assess the role played

by rural women in farming, it has emerged, that except probably ploughing, there is hardly any other field operation which is not performed by women. In comparison to men, women do extremely tedious, time and labour intensive work like sowing, transplanting, weeding and interculture, harvesting, threshing, transport and post harvest operations like shelling, cleaning, grading and processing, etc. All these jobs being non-mechanized have to be performed manually and, therefore, involve considerable amount of drudgery. Men, on the other hand are employed in those agricultural operations which are heavier, mechanized, involving less manual labour, and considered as prestigious and more paying in a typical "brains" vs "brawns" situation. Women, in general, provides 60-70 per cent of the labour input in production, processing and storage of food grains, which increases upto 80 per cent in hill agriculture and crops like paddy(Sanghi, 1990). In overall farm production, women's average contribution is estimated at 55 per cent of the total labour with percentages much higher in certain regions (Venkateswaran, 1992). In the Indian Himalayas a pair of bullocks works 1064 hours, a man 1212 hours and a woman 3485 hours in a year on a one-hectare farm, a figure which illustrates women's significant contribution to agricultural production (Singh and Shiva, 1988).

In addition to farming activities, women have exclusive involvement in the traditional roles of homemaker, caregiver, and wife. They perform numerous household chores. Besides, they also take care of the livestock. This clearly shows the extent of workload with which rural women are burdened. The agricultural activities in which women are engaged have serious consequences including health problems. For example back-ache, chest pain and miscarriage. Moreover, differences in size and stature, increased physical strain, and low maximal oxygen uptake may predispose women to ergonomic-related injuries. Therefore, it may be argued that the impact of work on family life is greater for women than for men. Since ages women have been using tools and implements which are less productive and energy consuming. Also the farm operations are repetitive and monotonous. All these factors have implications for the hardships faced by rural women.

Knowing how indispensable women are to agriculture in India, it becomes very important to improve the condition of women. Ergonomics can address the gruelling hardships faced by women. Ergonomics intervention has shown to be fruitful in alleviating the drudgery to a palpable extent.

1.2 Ergonomics, Agricultural Technology and Women: Ergonomics is a science that has been evolving over the last 50 years and has permeated almost each and every field concerning human activity. Polish scientist W.B. Jastrzebowski (1857) introduced the philosophical framework for the unique discipline of ergonomics (ergon + nomos), or the study of work. Ergonomics was proposed as a scientific discipline with a very broad scope and a wide area of interests and applications, encompassing all aspects of human activity, including labour, entertainment, reasoning and dedication (Karwowski (1991, 2001). Jastrzebowski (1857) divided work into two main categories: the useful work, which brings improvement for the common good; and the harmful work, which brings deterioration (discreditable work). Useful work, which aims to improve things and people, is classified into physical, aesthetic, rational and moral work. According to Jastrzebowski, such work requires utilization of motor forces, sensory forces, forces of reason (thinking and reasoning) and the spiritual force. The four main benefits of useful work are exemplified through property, ability, perfection and felicity (Karwowski, 2005).

The ergonomics discipline promotes a holistic, human- centered approach to work systems design that considers physical, cognitive, social, organizational, environmental and other relevant factors (Grandjean 1986, Wilson and Corlett1990, Sanders and McCormick1993, Chapanis 1996, 1999, Salvendy 1997, Karwowski 2001, Vicente 2004, Stanton et al. 2004) (cited in Karwowski 2005). The International Ergonomics Association (2003) defined ergonomics as: the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well- being and overall system performance.

Agriculture offers wide areas of scope for ergonomic applications. Over the years, farm work has not changed much. Many kinds of farm work are still carried out in stooped postures. Workers carry heavy weights in awkward positions, kneel often, work with their arms above shoulder level, or move their hands and wrists repetitively. Sometimes the whole body is subject to vibration from farm equipment. Besides these, the poor machine design and poor organization of work further contribute to the woes of the workers. As a consequence, farm workers suffer from back aches and pains in the shoulders, arms, and hands. A third of injuries are sprains and strains, and a quarter is back injuries. The technical term for these sprains and strains is work- related musculo-skeletal disorders. Ergonomics intervention can reduce the risk of musculoskeletal injury by providing information on musculo-skeletal injury, how to prevent them from occurring, how to improve the working environment and how to organize work (Shahnavaz et.al., 1991).

Advancement of science and technology has resulted in the development of new agricultural tools, equipments and machinery for farmers. New technology keep appearing in the market developed with the aim of simplifying agricultural activities. But if the technology developed is uncomfortable to its users and results in health hazards then such technology seldom meets its true purpose. Therefore, it is exceedingly important to design agricultural technology according to the specific characteristics of the intended users. Ergonomics principles can be successfully used to design agricultural equipment and machinery. By providing farmers with comfortable and energy conserving tools and equipments it is possible to diminish the burden associated with food production.

Over the past years, a number of agricultural tasks have been modernized/ replaced by technology. It is apparent that while the tasks performed by men have been mechanized, the activities performed by women have still remained manual. For the past decades, engineering development in agriculture has concentrated on large machines leaving small tools throughout the industry largely untouched and unconsidered. Thus development of agricultural technology has given little benefit to women who still drudge to

carry out agricultural operations. Instead, men have displaced them to even more unskilled jobs, taking their space. Furthermore, agricultural equipment is usually designed to match the physical requirements and capacities of men. Women by implication may have greater difficulty in operating it, and their risk of injury is enhanced. Also most of the research has focused on the men workers and women have been the neglected ones. More rigorous researches are needed to be carried out to gather data on women farmers in order to design new tools according to their capacities. Only this can reduce their drudgery and improve their quality of life.

1.3 Weeding: Weeding, an important agricultural operation, is performed by farmers to prevent growth of undesirable plants called weeds in the crop fields that hinder the growth of cultivated plants. Agricultural weeds may be defined as that part of the non-crop vegetation that reduces the quality of existing crops to such an extent that any net benefit of the weed plants themselves cannot compensate for their unfavourable effects on crops. Kline et al. (1969) reported that weed growth and weeding is the major restriction limiting the area which a small farm holder can crop effectively; Curfs(1976) reports work showing that uncontrolled weed growth in upland rice results in a yield reduction of at least 50 per cent; work at Uyole Agricultural college in Tanzania(1974-1975 season) indicated a similar reduction in yield due to weeds in maize.

Different methods of weeding are in practice depending upon the type of soil, sowing method and climatic zones. Alstrom has given the classification of direct cultural weeding based on Akobundu(1987) with some modifications as:

***manual weeding**

-hand pulling

-hand hoeing

-hand slashing

***mechanical weeding**

-animal –powered weed control

-machine-powered weed conrol

***tillage** (for seedbed preparation and weed free early crop growth).

As a result of technological revolution, chemical weeding i.e. the use of chemicals for controlling weed growth came into being. In case where area under cultivation is huge and manpower is less chemical weeding is usually preferred.

1.4 Rationale for the study: The present study focuses on the weeding operation. From the research conducted inside and outside India it emerges that weeding is a difficult operation involving a lot of drudgery on account of the awkward postures, traditional tools, and long working hours. The following sections bring out in detail each and every aspect of weeding operation.

1.4.1 Labour Intensive Nature of Weeding: - In terms of the amount of time that weeding occupies several studies have drawn attention to the labour-intensive nature of the task. Of the total labour involved in agricultural work during the cultivating season, as much as 15 per cent is spent cutting weeds from irrigated or dryland (Nag and Dutt 1979). Weeding utilizes about 20 per cent of the total human energy used in crop production (Gite and Yadav, 1990). Therefore, labour cost involved in weeding is high. Several studies have quoted that farmers concerned with labour cost have resorted to doing one late weeding rather than two timely weedings, in spite of the yield reduction which is known to occur when such practices are carried (Akobundu,1987).

1.4.2 Tools Used and Working Posture: - Various authors have highlighted the two distinct working postures that Indian agricultural workers adopt to carry out the weeding operation. They vary according to the soil condition. On dry land the worker adopts a sitting posture with one or both the legs flexed at the knee, and weeds are removed with the aid of the sickle. On watered land, workers bend forward in a stooping posture and remove the weeds by hand (Nag and Dutt, 1979; Nag and Chatterjee, 1981).

In India, the weeding operation is mainly carried out with indigenous short handled tools like 'khurpi', 'hand hoe', 'weeding hook' and spade etc. In some areas workers perform weeding operation in a bending posture using short handled weeding tools.

The study conducted by the International forum for Agricultural Development (IFAD) in African Countries namely Burkina Faso, Senegal, Uganda, Zambia and Zimbabwe showed that hand hoe was the key implement used by women for the weeding task.

1.4.3 Key Performers of Weeding Activity: - Though women in general participate in almost all agricultural operations, weeding is traditionally women's responsibility various authors underpin this, for instance Vedavalli and Sharma, 1997, Vedavalli, 1997, Saradamoni, 1991, Sharma, Tripathi and Gurung (1997). According to Shrivastava et al. (1997) Compared to other agricultural activities per cent involvement of women in weeding is highest. According of Chinnamani and Chandra (1990) about 80 – 100 per cent of weeding work in raising nursery for forestry as well as in aftercare is shared by women.

1.4.4 Drudgery Associated with Weeding Activity: - Research has indicated that weeding involves a lot of drudgery. The study conducted by the International fund for Agricultural Development (IFAD) in African countries namely Burkina Faso, Senegal, Uganda, Zambia and Zimbabwe reported that there was almost unanimous agreement among rural people that weeding was the hardest and most time-consuming job that women do on the land. Following are the extracts of the discussions with the women's groups in different countries.

> 'We punish ourselves to finish weeding a big field in a few days. Most women lose weight during the weeding season.' **Women's group, Zambia.**
> 'We really overwork ourselves when we are weeding.' **Women's group, Zimbabwe**
> Without weeding do not expect any harvest. The back has to ache to conquer the weeds!' **Women's group, Zimbabwe.**
> 'Oh, weeding is the most taxing job both in energy and time, because you have to bend down and work carefully not to damage the crop, pull out the weeds and shake them, while at the same you want to finish the operation before the weeds outgrow the crop'. **Women's group, Zimbabwe.**
> 'It is weeding that almost kills women!' **Men's discussion group, Uganda.**

All the above extracts reveal how difficult weeding operation is. Postures adopted for weeding operation put enormous strain on the backbone and have been implicated in various health problems suffered by women workers. The report by Murphy(1973), an orthopedic surgeon, summarized in the memorandum presented before the industrial safety board on the health effects of using short handled tools for hand weeding says as following:-

> "Maintaining the body in a bent position as is necessary when using the short hoe places great stress on the intervertebral discs of the spine which accelerates the development of degenerative arthiritis of the spine. Performance of even simple activities while in this bent position adds further stresses that are magnified many times over what they would be if performed in the erect position. The result is a worker whose spine ages much more rapidly than the rest of his body until a point is reached at which he is no longer able to work because of low back pain, even though the rest of his body may be young".

Evidence of the harmful physiological effects of hand weeding is also summarized in a 1993 memorandum from the California Occupational Safety and Health Administration (Cal/OSHA) Medical Unit. The memorandum describes hand weeding operations, which require workers to be bent at about 90 degrees at the waist and walk the fields in this position, or straighten up and bend down frequently at the waist. The memorandum concludes that the repetitive bending and prolonged stooping performed during hand weeding are nearly identical to the motions and posture used when weeding with a short handled tool and as a result expose workers to similar biomechanical stresses and risk of injury to the lower back. The above mentioned reports suggest severe consequences of working with the short handled tool.

Furthermore, the output with traditional hand hoe (Khurpi) is very low. It takes 300-700 man hours to cover one hectare depending upon crop, soil condition and weed infestation (Alam and Singh, 2003). The important factor associated with weeding is the time factor. There is limited time within which weeding needs to be finished. The workers are under constant pressure to complete weeding operation before weeds increase in height and become difficult to uproot. Therefore, women keep on weeding for long hours continuously to

finish weeding as soon as possible. Eventually, as the day sets off, they end up fatiguing themselves.

The discussion regarding weeding operation in the preceding sections suggests that weeding is a hard job, and women who are primarily held responsible for accomplishing this operation are at constant health risk on account of the strenuous postures assumed for long hours. The main reason behind strenuous postures is the short handled weeding tool. So if such a tool is introduced which enables the women to work faster and at the same time is comfortable and requires posture which is comparatively less strenuous, the work would be more productive, less energy consuming, and less fatigue producing.

By providing women with better technology to work with on the fields it could be possible to reduce the occupational hazards faced by these women. Various research institutes both at the state and national level are working on designing technologies for different agricultural operations. Better tools would reduce stress on the spine and lessen the back pain experienced by these women. The present study has attempted to assess the available weeding technologies on various ergonomic parameters. In the field of home management we are concerned with the problems of worker especially women workers. Women work not only in field but also in homes and their fitness and health are not only important for the individual but also for the family. One cannot neglect the health and fitness of the vital human resource both at family and national level.

The study was carried out in the Kangra district of Himachal Pradesh. Himachal Pradesh is a hilly state and therefore most of the agricultural operations are carried out manually except ploughing which is done with the help of bullocks. This shows that a lot of human energy is consumed in hill agriculture. The implements which have been in use are age- old and are labour intensive. The Kangra district represents all the agroclimatic zones of Himachal Pradesh. Select villages of Kangra district where women were

actively involved in farming especially weeding were focused upon. The study was carried out with the following specific objectives –

1.5 Objectives of the study

1. To study socio-economic, demographic, and anthropometric characteristics of the women involved in weeding operation.
2. To ascertain frequency of weeding, total number of days spent yearly on weeding operation, and posture assumed while carrying out weeding.
3. To find out the number of hours for which weeding is performed continuously, frequency of taking rest, and duration of rest period.
4. To assess the body discomfort experienced and identify body parts where pain is felt while working with traditional weeding tools.
5. To ergonomically assess the available weeding technologies on the basis of following parameters:
   (a) physiological cost of work (in terms of heart rate and energy expenditure)
   (b) muscular stress (in terms of reduction in grip strength)
   (c) discomfort experienced
   (d) postural stress
   (e) tool dimensions in relation to the anthropometric characteristics of the women
6. To find out weeding efficiency and output (area weeded) in relation to available technologies.
7. To suggest modification, if any, in the technologies tested for better performance.

1.6 Hypotheses

H_o 1 : There is a significant relationship between the body discomfort experienced by the women farmers and their selected personal, family, and situational variables.

H_o 2 : There is a significant variation among the weeding technologies in terms of the

-physiological cost of the worker

-body discomfort experienced

- area covered

-muscular stress

-weeding efficiency

-postural stress

-beats/m2

1.7 Delimitations of the study

1 Due to the scarcity of time the sample was restricted to the Kangra district.

2 Only four weeding technologies were tested