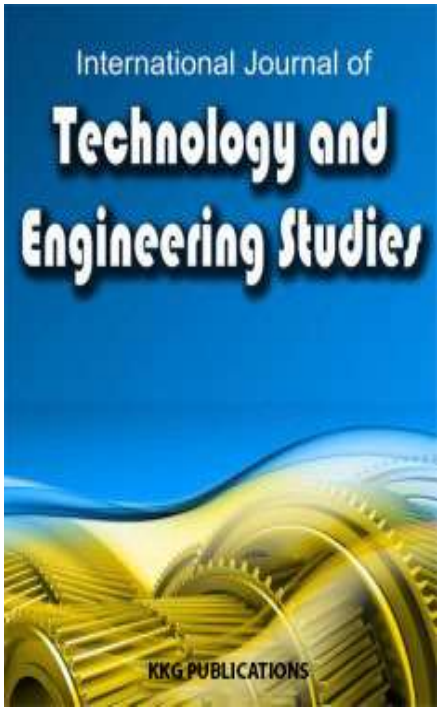

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ERGONOMIC TOOL DESIGN FOR TEA TRANSPORT PROCESS AT PT PERKEBUNAN NUSANTARA VIII

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Abstract. This research will be designed as a tool work for alleviating gripes pain experienced by workers in PT. Perkebunan Nusantara (PTPN) VIII uses REBA (Rapid Entire Body Assessment), a method taken into account for handling a system work. REBA is taken as input to make an ergonomic tool for the tea transport process. This study was conducted in the garden Ciater in picking the tea; in picking, several processes made one of the processes of transporting tea using sacks to be weighed and taken by truck to the mill for further processing. Primary data is data obtained directly through field observations. Data for working posture were taken in the form of photographs, especially from the appointment of workers plucking the tea bag. Posture assessment results showed the actual work at the highest risk level requiring immediate corrective action with the value of 8 that highlights the necessary improvements to the working posture. The corrective action taken is to design aids, folding trolleys, which in its design is based on the needs of workers and the state of the field.

INTRODUCTION

According to Occupational Safety and Health Administration [1] Ergonomics is applied science of equipment design (for the workplace) intended to maximize productivity by reducing the operator's fatigue and discomfort. Ergonomics is the science of fitting jobs to people. Ergonomics encompasses the body of knowledge about physical abilities and limitations as well as other human characteristics that are relevant to the job design. Ergonomics is the application of this body of knowledge to design of the workplace [12]. Good ergonomic design makes the most efficient use of worker's capabilities while ensuring that job demands do not exceed those capabilities. When defined in terms of science, ergonomics is the science of designing products that work in accordance with the way humans think, see and behave. Products that are compatible with people will dramatically reduce human error, fatigue, discomfort and stress and have a profound positive impact on overall end-user performance [9], [10].

In farming OSHA states that every employer must furnish each employee with a place of employment free from all hazards causing or likely to cause death or serious injury. A Hazard is anything that could hurt you or make you sick.

The process of selecting and modifying tools, especially hand tools, to provide a better fit for the user is something everyone at one time or another has attempted to do in daily life.

In the last decade, tremendous strides have been made in design and development of hand tools in an attempt to reduce the problems, including potential injuries to the worker, while also increasing tool efficiency.

Developing a "single standard" for ergonomic tool design is difficult because of the variation in human anthropometry. Therefore, investigation of appropriate tool design and of using hand tools while utilizing proper ergonomic principles continues to evolve. There are guidelines and methods, however, by which tools can be tested to effectively evaluate specific ergonomic features. In the general, ergonomic hand tools features can be classified by the following design goals : decrease tech force or grip strength required to use the tool, decrease repetitive motion associated with using the tools, decrease awkward body postures or wrist position when using the tools, decrease vibration transmitted to the hand and wrist.

PT. Plantation Nusantara (PTPN) VIII is one among the state-owned plantations. This study was conducted in the garden Ciater in the process of picking the tea; in picking there are several processes that made one of the processes of transporting tea by using sacks to be weighed and taken by truck to the mill for further processing. The tea sack has an average weight of 25 kg/sack. Conditions of work posture of PTPN VIII Gardens Ciater workers plucking tea are still much unnatural. They trigger a bad posture and Musculoskeletal Disorders (MSDs). To obtain information confirming that there are no allegations of MSDs, use the Nordic Body Map (NBM) [11]. Following was the initial survey conducted in the first special unit of workers in the transport of tea which consisted of 4 people in standing position, with hands raised and having excessive burden on the hands.

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LITERATURE REVIEW

Ergonomics is a multidisciplinary science that endeavors to make a better fitting between the job and the worker to make them safe. Some branches of ergonomics are defined as "micro-ergonomics", macro ergonomics, cognitive ergonomics, and environmental ergonomics"; however, micro ergonomics is acknowledged to be the main problem among farmers [2].

According to the ILO, agriculture is defined as: "Agricultural and forestry activities carried out in agricultural undertakings 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" [3]. Generally, agricultural activities, which range from the plantation and harvesting by manual tools to the usage of tractors and other mechanized equipment, create some musculoskeletal risk factors, which result in various sprains, strains and back problems [4].

According to the International Labor Organization (ILO) around 2.3 million workers die per year because of occupational accidents and work-related diseases, also, every year, about 337 million occupational accidents and 160 million work-related illnesses occur around the world [5]. More than one million workers suffer from some kind of injury every year in which over-exertion, awkward postures, and repetitive motion are the primary causes. In this respect, agriculture is acknowledged to be a high risk job and includes many sorts of occupational risk factors that threaten farmers [6]. Static postures, manual lifting and carrying as well as the awkward postures during the job are some samples of the risk factors that might result in musculoskeletal illnesses [7-8]. In addition, these injuries lead to loss of time and money. According to [2] ergonomists are able to develop and introduce some feasible solutions for agricultural task, which are affordable in terms of economic concept, especially for lower income societies. The Table 1 shows that the ergonomic and occupational health studies in agriculture have been conducted in both developed and developing countries.

TABLE 1
RESEARCH AREA OF ERGONOMIC CONCEPT AND METHODOLOGY [2]

Authors	Country	Research Methodology	Approach			
			Ergonomic Design	Ergonomic Task Analysis	Educational	Epidemiologic
Scott Fulmer et al (2002)	USA	Descriptive		v		
Susan E. Kotowski et al (2009)	USA	Interventional	v	v		
Eun Shil Cha, et.al (2009)	Korea	Case Series				v
Bhattacharyya & Chakrabarti (2012)	India	Interventional	v	v		
Simone (2012)	Brazil	Cross-sectional	v	v		
Vyas (2012)	India	Interventional			v	

RESEARCH MODEL

Stage of problem identification is an initial stage in this research activity. This step is to identify in PTPN VIII Gardens Ciater the formulation of the problem that occurred in PTPN VIII Gardens Ciater and to solve the problem by using REBA method to achieve the research objectives.

a. Primary data is data obtained directly through field observations. At this stage, a direct observation is made at the time the activity of tea plucking was being conducted at 07:00 to 12:00 from the plantation, namely in PTPN VIII Ciater Gardens.

b. The data used were assessed for the work posture by applying REBA upon existing condition. Data for working posture were taken in the form of photographs, especially from the appointment of workers plucking the tea bag.

Data Processing Method

The data processing is done in stages as follows:

- Data processing results are obtained through Body Nordic Map to determine the body experiencing pain level transform and know which part is at risk of MSDs.
- Determination of the level of working posture actions with REBA method.

- Design work tool based on the results of previous data processing.
- Analysis of working conditions after the repair is done.

DATA ANALYSIS

In the process of plucking the tea there are many steps that must be passed to later be taken to the mill to be processed further. Figure 1 illustrates the stages of what is being done, in this study will focus only on the transport of tea. The process of transporting sacks of tea on existing transport is made possible by 2-3 workers in one unit. 1 unit contained in the transport has workers, each of which will carry one bag weighing 25 kg fruit to be brought to the scales and transferred to trucks that will be delivered to the factory PT. PTPN. How to bring the tea bag is made possible through just one way that the workers carry them on the head.

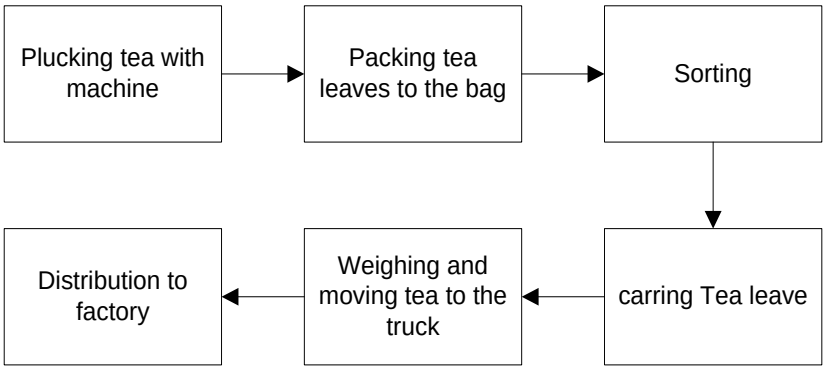

Fig. 1. Tea plucking process

Fig. 2. Working postures

Nordic Body Map

Nordic Body Map questionnaire was given to four people working on the process of picking on the carriage, the results are shown in Figure 7. Judging from the graph above that shows the results of Nordic Body Map, the majority of tea workers hauling big sacks experienced the highest MSDs'

risk especially at the neck top and bottom , left and right upper arm, left forearm and the right one.

Determination of Level of Actions in Working Posture through REBA

Posture assessment work on existing transport of tea using REBA gets results as drawn in 6.

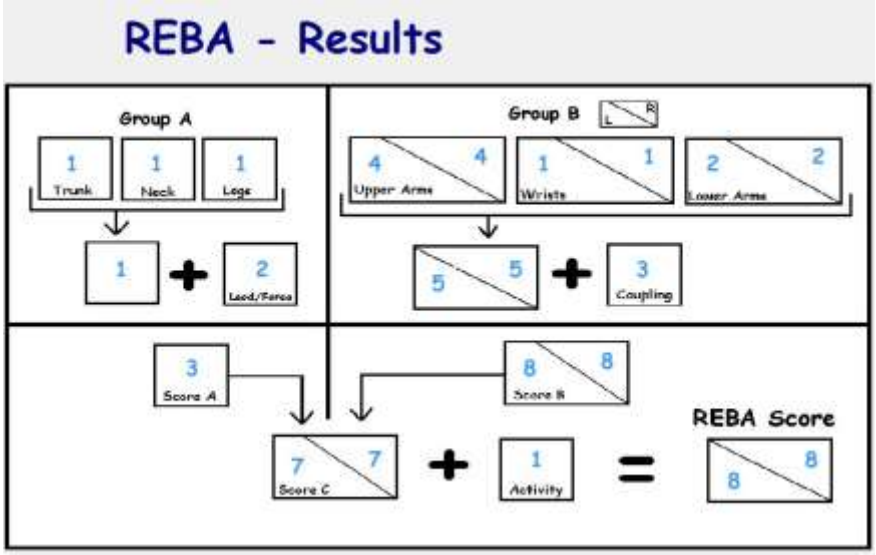

Fig. 3. Reba result

Existing REBA value obtained was 8, when seen in the table of risks and measures; the value of 8 has a high level of risk so that action is urgently needed. It can be judged from the activities undertaken by workers and the pain associated with the load received. In this research, analysis of posture and designing tools to reduce the risk of MSDs in experienced workers has been done.

Ergonomic Tool Design

Results of the analysis above show that the activity of transporting tea may pose a risk of MSDs. Therefore, the design work is necessary for tools proposed to reduce this problem. The proposed work tool is a trolley which can be folded so it is expected to reduce the perceived risk of MSDs in operators. The draft proposal has a detailed trolly design discussed that can be seen below:

Fig. 4. Proposed figure wheels

Figure 4 shows the proposed design of the wheels used for trolley, using which will make it easier to move the trolley over uneven streets as in plantations.

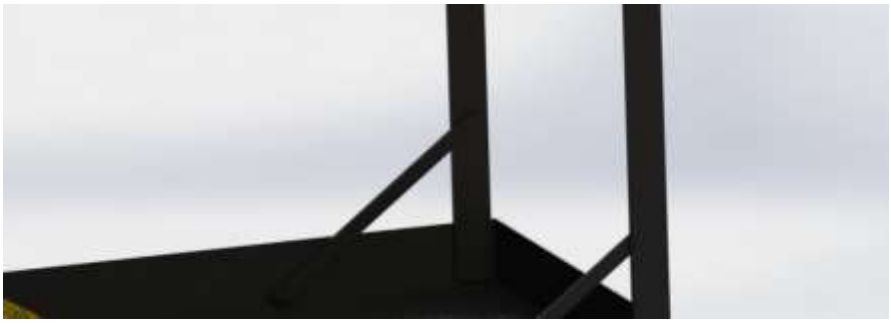

Fig. 5. Mechanical elbow

Figure 5 shows the design of a trolley that has elbow, with such a mechanism that allows the trolley to be used and folded so it is easy to carry trolley when plucking tea in the hills.

Fig. 6. Retaining belt

Figure 6 shows the design of a trolley that has elbow, with such a mechanism that allows the trolley to be used and folded so it is easy to carry the trolley when plucking tea in the hills.

Fig. 7. Proposed draft trolley folding

Figure 7 proposed draft trolley folding in the picture shown where the proposed overall design inside looks 3 dimensional. In this picture all parts contained in trolley can be seen. A shape like this can help workers be more comfortable in work and reduce the risk of MSDs.

CONCLUSION

An analysis has been done of the body section of workers who were very sick, especially having pain in the upper and lower neck and arms. Posture assessment results showed the actual work that is at the highest risk level requiring immediate corrective action with value of 8 that highlights the necessary improvements to be

made to the working posture. The corrective action taken is to design aids, folding trolley which in its design is based on the needs of workers and the state of the field.

Declaration of Conflicting Interests

This study has no conflicts of interest.

REFERENCES

[1] Occupational Safety and Health Administration (OSHA), "Ergonomics program standard," *Federal Register /Rules and Regulations, Washington, DC*, pp. 65-220, 1999.

[2] H. S. Naeini, K. Karuppiah, S. B. Tamrin and K. Dalal, "Ergonomics in agriculture: an approach in prevention of work-related musculoskeletal disorders (WMSDs)," *J. Agric. Environ. Sci.*, vol. 3, no. 2, pp. 33-51, 2014.

[3] P. Hurst and P. Kirby, "Health, safety and environment: A series of trade union education manuals for agricultural workers," 2004.

[4] D. Villarejo and S. L. Baron, "The occupational health status of hired farm workers," *Occupational Medicine (Philadelphia, Pa.)*, vol. 14, no. 3, pp. 613-635, 1998.

[5] S. Niu, "Ergonomics and occupational safety and health: An ILO perspective," *Applied Ergonomics*, vol. 41, no. 6, pp. 744-753, 2010.

[6] J. J. Mazza, B. C. Lee, P. D. Gunderson and D. T. Stueland, "Rural health care providers' educational needs related to agricultural exposures," *J. Agric. Saf. Heal.*, vol. 3, no. 4, pp. 207-215, 1997.

[7] J. R. Myers and K. J. Hendricks, "Injuries among youth on farms in the United States", 1998. Cincinnati, OH. DHHS (NIOSH) publication, pp. 154, 2001.

[8] E. Nurmianto, *Ergonomics: Basic Concepts and Applications*. Surabaya: PT Wijaya, 2008.

[9] H. Iridiastad and Yassierli. *Ergonomics an Introduction*. Bandung: PT Youth Rosdakarya, 2014.

[10] A. Madyana, *Design Analysis Work and Ergonomics*. Yogyakarta: Univrsitas Atma Jaya Yogyakarta, 1996.

[11] V. Putz-Anderson, B. P. Bernard, S. E. Burt, L. L. Cole, C. Fairfield-Estill, L. J. Fine and N. Nelson, Musculoskeletal disorders and workplace factors. *National Institute for Occupational Safety and Health (NIOSH)*, 1997.

[12] N. Staton, *Handbook of Human Factors and Ergonomics Metods*, New Jersey, 2005.

[13] J. R. Wilson, Fundamentals of systems ergonomics/human factors, *Applied ergonomics*, vol. 45, no. 1 pp. 5-13, 2015.

[14] P. Polášek, M. Bureš, and M. Šimon, Comparison of digital tools for ergonomics in practice. *Procedia Engineering*, vol. 100, pp.1277-1285, 2015.

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