Tarım Makinaları Bilimi Dergisi (Journal of Agricultural Machinery Science)
2011, 7 (2), 133-136

Work Load Examinations at the Log Wood Production

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Received (Geliş Tarihi): 08.05.2011 Accepted (Kabul Tarihi): 09.07.2011

Abstract: Beside specific process characteristics, the unspecific factor of the work load shall be arised and used for an evaluation of the log wood production for fireplaces. The working flow - beginning with the operating cycles, ending with different composed production paths - shall be examined and with the so called OWAS-method dedicated to action categories (OWAS = Ovako Working Posture Analysing System). If it is possible this abstract index shall characterize in an understandable way the work load, so that one can give an application recommendation of the operating cycles.
Key words: Log wood, work load, OWAS, time measurement, work science

INTRODUCTION

In the 60ies of the 20th century when the use of oil for heating systems came up in Germany, wood was replaced out of the energy supply. During the last ten years the use of wood has increased steadily, because people have realized the finite nature and instability of fossil fuel supply.

Nonetheless the production of log wood is inhibited, because it needs a lot of time and is done with a low degree of mechanisation and therefore is seen as a hard work to do. You cannot see impartially how the different methods of log wood production cause an impact on the healthiness of the workers and how a higher degree of mechanisation could prevent such impacts. Improved knowledge and deduced optimisation approach was desirable.

Besides specific process characteristics, the unspecific factor of the work load was measured with the OWAS-method (OWAS = Ovako Working Posture Analysing System) in order to get an overall assessment of the split wood production for fireplaces. Therefore all sequences of work steps were examined. The abstract index you get shall be shown in an understandable context and be used as a reference for improvements. A second improvement of the measuring method was the use of a camera, so that the workers could be examined in their real work environment.

The results lead to an overall assessment of the log wood production shown in four scenarios.

MATERIALS and METHOD

In this study, the log wood production was examined, in order to get a number which describes the work load. With the help of videos the work was analysed. In the following lines the method will be described.

Determine the work load by OWAS

The method of the work load by OWAS (Ovako Working Posture Analysing System) was developed in a private finish steel company in 1974. The aim was to determine if current postural demands are acceptable and establish baseline to evaluate effectiveness of interventions identify job attributes associated with awkward postures evaluate intervention effectiveness by comparing to baseline according to Stoffert (1985). Later on it was tested in mining or wood industry. As a result of this a standardized scheme for analyzing working postures was established.

The OWAS-method can be divided in a basic method and a punctual method according to Stampfer (1996). Punctual examinations only look at the posture of the arms e.g. while sitting. The standard

OWAS-examination, which was used in this examination, is used examine work, which is done with the whole body. You can say something about:

- The used working postures
- The relative time part of the working postures
- The working element, which can be allocated to the working posture
- Rating postural stress
- Give actions, which shall be done to improve the working postures at the certain working places
- The weight which must be carried and the need of power to be able to do it

The OWAS method is based on the idea of making momentary observations of postures at certain intervals of the jobs studied and, after receiving sufficient observations, reliable material is available to describe the postures of the job as a whole. It requires only a few seconds to perform an observation and to record it.

The OWAS method identifies the most common postures. 14 basic postures are divided in three groups (Figure 1): 4 postures for the back, 3 postures of the arms and 7 postures for the legs. Each posture is related to a number. As a result of this you get a code with three numbers with possibly 84 combinations. If you need the weight of the things the worker holds, then you add a fourth code number: „1" means weight up to 10 kg, „2" between 10 and 20 kg and „3" higher than 20 kg.

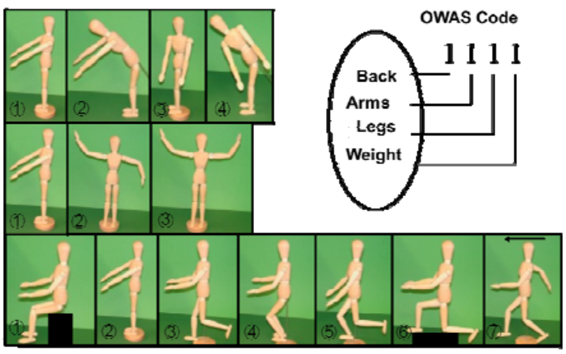

Figure 1. Standard postures with their related numbers for the OWAS evaluation Code system

With the number for the weight you get 252 possible combinations. Each posture with its 4-number code is assigned to an action category according to Loeffler (1992):

Action category 1: Work postures are considered usually with no particular harmful effect on musculoskeletal system. No actions are needed to change work postures.

Action category 2: Work postures have some harmful effect on the musculoskeletal system. Light stress, no immediate action is necessary, but changes should be considered in future planning.

Action category 3: Work postures have a distinctly harmful effect on the musculoskeletal system. The working methods involved should be changed as soon as possible.

Action category 4: Work postures with an extremely harmful effect on the musculoskeletal system. Immediate solutions should be found to change these postures.

Figure 2. OWAS Code example for work postures – Code 1111

Figure 3. OWAS Code example for work postures – Code 2151

For example the posture of the picture 2 on the left side will get the code 111, on the right hand side 215. The weight of the wood is under 10 kg therefore the code gets another 1 at the end. The left side gets an action category of 1. The ride side gets an action category of 3. The classification of the action categories is done by experts, medicines and physiologists of the finish heavy industry (Peters 1991).

At the OWAS method the working postures were examined with an activity sampling after Stoffert (1985). Normally the examiner stands beside the test person and notes the postures in certain intervalls (mainly all 30 seconds). In this study the examination was done with the help of videos (camcorder) which were made several days of the work were filmed and evaluated. As result of this you get a representative sample with the relative frequency of the action categories (AC). With this you can calculate a certain work load index after Lundqvist L (Lundqvist 0) with the following formula:

$$L = (1*AC1) + (2*AC2) + (3*AC3) + (4*AC4) \quad (1)$$

The frequency bandwidth of this index L is from 100 to 400. Like this it is possible to compare different work, too (Loeffler 1992). The index stands for the whole work and is the main result of the work load examination.

Subject of investigation

9 different parts of the wood log production process were examined with 12 test persons. Beside some forest science students the test persons were professional forest workers. 37,7 hours film were evaluated, which means that 4213 pictures were examined in advance of the evaluation. All 30 seconds a photo was made out of the video and examined with the help of a computer program called "WinOwas" fom Tampere University in Finland. WinOwas assigns automatically each working posture to the action categories.

RESULTS and DISCUSSION

With OWAS method and the analysis of the pictures the applied load index after Lundqvist was investigated for each branch of the process chain of the log wood production. All values are related to the raw working time.

Example timber harvesting

For the investigation of the work load of the timber harvesting (thinning) of a young forest (15 years) 282 moments out of two thinnings were investigated. The result was L = 186. Compared to the other working sectors, this work load can be called quite heavy. The highest value got the working element „pruning" (Figure 4 - L=220). With 36% of the time need, this element had the highest part of time as well. The lowest work load was investigated for the working element "going", which means going to the next tree, which shall be cut.

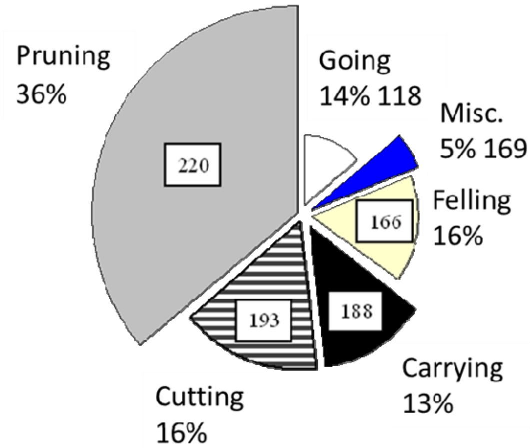

Figure 4. Partial work load L and time parts of the working elements at timber harvesting (thinning)

Like this several working elements of the log wood production were investigated:

- Thinning
- Axing
- Vertical wood splitter
- Horizontal wood splitter
- Small combination cutting/splitting
- Big combination cutting/splitting
- Circular saw
- Bundling
- carrying
- Piling

Camparison of process elements. The indices of the work load for "Thinning", "Axing", und "Carrying" are quite high with L=186, L=179 und L=176, which can be seen in figure 5. The values for "Circular saw", "Vertical wood splitter" and "Bundling" are intermediate with values about L=140, whereas the values for „horizontal wood splitting" and the work with machines which combine cutting/splitting are low, like it was expected (L=109 to 118).

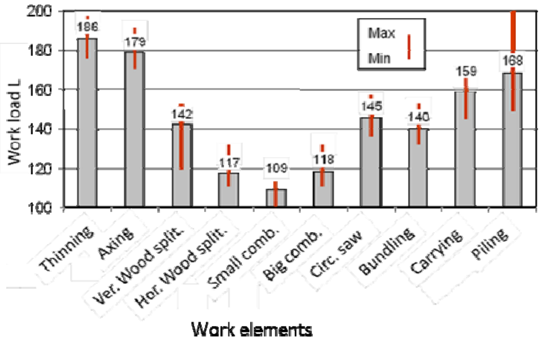

Figure 5. Work load L for the various possible working parts of a log wood production process (beginning with the lowest OWAS value 100)

CONCLUSIONS

The followings were concluded from the study: It is possible to evaluate the work load of the log wood production with the OWAS method. It was very helpful to use a camcorder at the investigation and therefore this method is recommended for further investigations. The bandwidth of the Lundqvist factor in this investigation was from L=109 to L=189. At working elements like "Carrying wood" it was possible to get higher values (more than L=200). It is clear that one should avoid long lasting work with postures which lead to values over L=200.

In the light of these results the Lundqvist factor should be described in a more common way. A suggestion out of this investigation is in the following lines:

L= 100 to 120 – very little irksome,	colour
L= 121 to 140 – little irksome,	colour
L= 141 to 160 – rather irksome,	colour
L= 161 to 180 – irksome,	colour
L= 181 to 200 – very irksome,	colour
Over 200 – very very irksome,	colour

This classification should help to express the work load more understandable and it should make it easier to understand a working process in advance and to give instructions concerning the selection of the machines or the need of pauses for the workers.

ACKNOWLEDGEMENTS

The author would like to thank the Technologie- and Förderzentrum in the center of excelence for renewable energies in Straubing (Bavaria, Germany) where the investigations were done. This study was funded by the Bavarian State ministery for agriculture (BayStMELF).

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