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Mathematical modeling of anthropometric data of agricultural workers

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ABSTRACT

An anthropometric survey of agricultural workers from Konkan region was carried out during 2004-2006 in order to investigate suitability of farm equipments with human body. Seventy-nine body dimensions and sixteen strength parameters were measured from 649 male and 377 female workers within the age group of 18 to 60 years. The pertinent anthropometric dimensions were identified and were grouped based on the relation between each other. The mathematical modeling was performed between the base parameter and sub-parameter from same group using 'Table Curve 1.0' package. The highest r^2 valued relationships were selected and finally reduced to the normal form. It was found that five base parameter can be utilized to predict thirteen sub-parameter. Hence, around 16% of drudgery involved in measuring of anthropometric parameters is reduced by developed model.

Key words : Anthropometry, Modeling, Agricultural worker.

Anthropometry is fundamental to successful design. Anthropometry deals with measurement of physical features of human body including linear dimensions, weight and volume. It is critical for the designer to consider the human being intentionally and thoroughly from the conception of the design (Gupta and Sharma, 1979) rather than as an incidental or add-on part of design. The man-machine interface decides the ultimate performance of the equipment/work system. Anthropometric measures vary considerably with factors such as gender, race and age playing a dominant role in this variability. Similarly the agro-climatic zone and topography adds to the variability in human characteristics. Largely the anticipated user population therefore, controls the application of anthropometric data.

Comfort, physical welfare and performance of agricultural workers using farm implements are influenced by relevant features of human body such as body dimensions, range of body movements and strengths. Hand tools, animal drawn equipment and tractor/power tiller operated machinery are being developed, manufactured and extensively used for different farm operations in India. All of them are either operated or controlled by human workers (Hertzberg, 1968). Therefore to achieve enhanced performance and efficiency of man-equipment system along with better comfort and safety of the operators, it is necessary to design various tools, equipments and work places keeping on consideration the anthropometric data of agricultural workers. Hence to achieve better efficiency of performance with more human comfort, it is necessary to design the implements keeping in consideration the operator's capabilities and limitations. Use of anthropometric data in design of agricultural implements is one step in this direction.

Agricultural mechanization has increased considerably over the past few years in India. But little anthropometric data is available for looking into the ergonomic problems of mechanization (Sen *et al.*, 1977).

METHODOLOGY

The group of agricultural workers involved in field work, operation and maintenance of agricultural equipment is defined as the total user population. Therefore, a smaller group called sample is selected and measurements are carried on the individuals in that sample. The sample size was taken as 1000. The survey was conducted in the Konkan region of Maharashtra state. The distribution of 1000 samples (agril. workers) is given in the Table 1.

The random sample should be taken from the user population, however, in large-scale anthropometric survey; the ideal random sample procedure is not feasible. To make the sample representative it is desirable to take sample from each district of Konkan.

Keeping into consideration, the design requirements of hand tools, animal drawn equipment, tractor, power tiller, power operated machines, self-propelled machines and workplaces, a total 79 body dimensions were identified by the coordinating cell of All India Coordinated Research Project (AICRP) on Ergonomics and Safety in Agriculture (ESA) (Gite and Chatterjee, 1999).

Equipments used for data collection:

Seventy nine body dimensions were measured using Integrated Composite Anthropometer (ICA) developed