ABSTRACT

An investigation has been carried out to design and develop a side lever operated knapsack sprayer from mechanical and ergonomical considerations. Accordingly a product information survey and a users' survey are carried out to collect background information. The data of one survey reveal that most of the LOK sprayers in India use piston pumps and have the operating handle on the side. The data of other survey covering 5340 users from the entire cross section of the country suggest the need to redesign the LOK sprayer so as to reduce the drudgery involved in its operation. To achieve this, as a first step, anthropometric data concerning body dimensions, strength and back profile are collected from a sample of user population and judiciously incorporated in the design of sprayer components.

In order to express the method of stroke application during handle operation of a LOK sprayer, a concept of `C' ratio is introduced and its value in normal operation is found to be 0.18.

A rig for motorized operation of a LOK sprayer is developed. With the help of this rig, data on force requirement in handle operation are collected. These are used to develop a model. The predicted values of force using this model are observed to be in close agreement with the measured values, the maximum deviation being within ±10 per cent.

Another laboratory study has been carried out to optimize three handle operating parameters namely frequency, force and range of movement, from ergonomical considerations. The optimum values for these parameters are found to be 20.2 strokes / min, 59.6 N and 45.5° , respectively.

Two studies on load carrying in backpack mode are carried out. Data of one study indicate that the discomfort will be minimum when the centre of gravity of load is as close to the body as possible in horizontal direction and at 22.5 cm above lumbosacral joint in vertical direction. The optimum strap spacing for a backpack is found to be 16.1 cm. From the other study, the optimum backpack load from ergonomical considerations works out to be 18.7 kg.

On the basis of the data collected through various experiments, a new LOK sprayer has been developed and its performance evaluation has been carried out alongwith two existing sprayers. The newly developed sprayer is found to be superior to the commercially available units in terms of mechanical as well as ergonomical performance.

KEY WORDS : LOK SPRAYER, USERS'SURVEY, ANTHROPOMETRIC SURVEY, ELBOW STRENGTH, BACK PROFILE, EXPERIMENTAL RIG, HANDLE FORCE, ANALYTICAL MODEL, HANDLE FREQUENCY, BACKPACK LOAD, ERGONOMICAL EVALUATION, IMPROVED LOK SPRAYER