

An ergonomic intervention to reduce back strain among apple harvest workers in New York State

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Abstract

The impact of modifications to the apple picking bucket on common picking postures, self-reported comfort, ease of use, and speed of harvest were measured. Fourteen apple pickers wore an intervention hip belt, were interviewed and measured using posture-activities-tools-handling methodology. The use of hip belt did not significantly alter time spent in various postures. 78.6% of interviewed workers preferred the modified bag, 71.4% noted a difference in the back, neck, or shoulder, while 64.3% said regular use of modified bag would slow their work. Major themes in worker comments are discussed. The hip belt modification to apple harvest bag seems generally acceptable to workers, but needs further development to overcome unintended effects. Although work sampling demonstrates that the bag does not affect work practices, workers appear somewhat concerned that productivity will be negatively impacted. Further training of workers in the use and potential benefits of bag are needed.

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1. Introduction

Throughout the US, migrant and seasonal farm workers hand harvest a wide variety of ground, bush and orchard crops for which mechanized harvest is not technically or economically feasible. This harvest work involves long hours of reaching or stooping and carrying heavy loads, often under extreme weather conditions. Although ergonomic research in hand-harvest labor is increasing (Meyers et al., 1998; Sakakibara et al., 1995; Calisto et al., 1997; Miles and Steinke, 1996; Baron et al., 2001), the health and safety hazards associated

with this work have not been as thoroughly studied as in many other industries.

In New York State, apples are hand harvested by workers who carry them from the tree to 20-bushel bins. The buckets used to carry the apples can weigh as much as 40 pounds when full. Fig. 1 shows a worker using a traditional apple bucket. Harvest work activities include climbing ladders, picking apples, and carrying full apple bags down the ladder to empty them into the apple bin, which is usually located between five and twenty yards from the worker. These activities require the worker to assume a number of awkward postures, ranging from leaning far to one side while standing on a ladder, to stooping down to release the apples out of the bottom of the apple bag through a drawstring opening, to holding both hands over the head for prolonged periods. Fig. 2 illustrates an apple harvest worker leaning during

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Fig. 1. Apple harvest worker carrying full bucket of apples over one shoulder.



Fig. 2. Apple harvest worker leaning to pick.

picking. Many of these postures are assumed while the apple bag is full or partially full, which increases the likelihood of muscle and joint strain injuries. The postures associated with these activities have been cited in a number of studies as being related to musculoske-

letal disorders (Pinzke, 1997; Meyers et al., 1998; Pan et al., 1999; Calisto and Kleisinger, 2001; Bjelle et al., 1979; Sakakibara et al., 1995).

Previous research by the New York Center for Agricultural Medicine and Health (NYCAMH) suggests that back, neck and shoulder strain is a common problem among orchard workers (Earle-Richardson et al., 2003). This is consistent with other similar studies (Sakakibara et al., 1995; Calisto et al., 1997). Further research (Earle-Richardson et al., 2004) found that workers spend three-quarters of the time with a full or partially full bag and significant amounts of time in awkward trunk, arm or leg postures. This research also identified significant intervals of doing both of these in combination. Other studies have found proportions of apple hand harvest time spent with hands over the shoulder in a range from 40% to 50% (Calisto and Kleisinger, 2001; Sakakibara et al., 1995).

The identification of high proportions of working time spent with heavy loads and in awkward postures underscores the need for the development of load or posture-modifying interventions. Once developed, such interventions must be evaluated according to a number of criteria before producing and testing on a large-scale. Specifically, it must be determined whether the intervention is likely to be effective in the orchard environment and is acceptable to workers as well as to the orchard enterprises.

In this study, a community ergonomic work team made up of research staff, farm workers, orchard owners and other agricultural community members developed two ergonomic modifications to the apple-harvesting bag. One of these alterations was then evaluated by working apple harvest workers for overall acceptability, comfort and impact on picking speed.

2. Methods

2.1. Development of the ergonomic intervention

During 2001–2002, researchers held seven group meetings with orchard owners and managers, farm workers, and other apple industry representatives. When individual orchard owners were unable to attend these meetings, an interviewer was sent to the farm to obtain their input.

The goal of these meetings was to identify several intervention concepts and collaboratively select one to test in the orchard. This ergonomic team process is consistent with methods used in a number of agricultural ergonomic studies (Miles and Steinke, 1996; Baron et al., 2001; Ehlers and Palermo, 1999; Meyers et al., 1997; Zalk, 2000).

The meetings and interviews included an introduction to ergonomic principles, a presentation of the ergonomic

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