Cumulative Trauma Disorders in Forest Nursery Workers[1]

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Abstract - This study focused on the upper limb injuries suffered by up to 31% of seasonal nursery workers in British Columbia nurseries. Problems occurred primarily in right hand flexors and both shoulders; subjects with no first aid problems were slightly older, had more work experience, and used the neutral hand position more frequently when working. Recommendations include training, rest breaks, maintenance of constant workplace temperature, and the purchase of sit-stand stools.

INTRODUCTION

Logging is one of the major industries in Canada. In order to ensure logging in the future, Canada has an intensive reforestation program, though many feel it is not sufficient. Part of the problem is associated with the occupational health problems experienced by many sorters.

In British Columbia, government nurseries plant and harvest more than 110 million seedlings per year. This represents approximately 50% of the total seedlings raised for reforestation. These nurseries employ approximately 800 workers at the peak of the sorting season. In 1985, 33 Workers Compensation claims involving upper limb injuries to sorters were filed, resulting in 689 lost work days, direct costs of $28,000, and estimated indirect costs of $112,000.

The workers' jobs in the nurseries are very manual intensive, requiring no tools other than the worker's two hands. In the early months of each year, seedlings are lifted from the ground and stored in cold rooms to inhibit their growth. Boxes of chilled seedlings are distributed daily to sorters in a sorting shed, who sit on a stool or stand at a flat work surface. Sorters wearing rubber gloves for protection from chemicals separate the seedlings, using the index or middle finger from the dominant hand to pull while holding the entangled bundle in the other hand. The separated seedlings are sorted or graded into groups suitable for reforestation planting or for discard. Sorters sort approximately 6000-7000 seedlings per day. Bundles of sorted seedlings are placed on a conveyor belt and are transported to a wrapper who packages them in cellophane and chops off trailing roots.

The management of the occupational health problems of nursery workers is made difficult by several factors:

1) The time period for lifting and sorting the seedlings changes from year to year and cannot be determined more than a week or two in advance.

2) Sorting crews consist of both experienced and inexperienced workers.

3) Most ergonomic studies relating to upper limb disorders focus on redesign of hand tools, which are not used in this situation.

METHODS

To assess the extent of the occupational health problems experienced by nursery workers, a questionnaire was developed and distributed at the end of the sorting season to three nurseries and also to head office staff (for control). Approximately 500 subjects were surveyed. Workplace factors were assessed through the questionnaire and by measuring the dimensions of the workstations.

First aid reports gathered during the sorting season were assessed to identify the most common areas of injury and the types of injuries experienced. In addition, all upper limb musculo-skeletal injuries were more accurately defined by having the person affected shade in areas on a body diagram.

Because of the numerous hand manipulations performed during a shift, certain hand motions are believed to contribute to the health problem. Ten tree sorters (five healthy and five infirm) were videotaped. Eighty hand motions per subject were analyzed in 0.5 second intervals. The shoulder, elbow and wrist joints were reported in either a neutral, flexed, or extended position. Hand deviation was reported either as ulnar, radial, or neutral.

RESULTS

Of the 500 questionnaires distributed, 447 nursery questionnaires and 17 office questionnaires were returned. All subjects reporting arthritis or fractures in the upper limb body parts were removed from the study group, thus eliminating 100 subjects. Responses were then analyzed according to work location, job category, and reporting or

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non-reporting of hand problems. The resulting subject group totaled 275, with 118 reporting hand problems and 157 having no hand problems. By analyzing certain questionnaire responses using this breakdown, and using the non-parametric z-test, an attempt was made to determine why certain workers experience problems and some do not.

Table I shows that healthy subjects were slightly older and had more work experience as sorters and wrappers, while Table II indicates that infirm subjects consistently experienced significantly ($p<0.05$) more right, bilateral, and frequent hand and shoulder problems.

Table I. -- Characteristics of Healthy and Infirm Subjects.

	Infirm		Healthy	
	Mean	SD	Mean	SD
Years Worked	4.9	3.6	5.2	4.7
Weeks Worked	11.4	7.6	12.2	9.7
Age	35.8	10.1	37.4	11.8
Height	65.0	2.5	64.7	3.1

SD=standard deviation

Table II. -- Distribution of Hand and Shoulder Complaints

	Infirm	Healthy
Hand Discomfort		
Right	43 (36)	
Left	14 (12)	
Both	60 (51)	
Shoulder Discomfort		
Right*	21 (18)	14 (9)
Left	5 (4)	3 (2)
Both*	40 (34)	28 (18)

* = significant ($p<0.05$)
Numbers in brackets represent percentages.

Infirm subjects experienced tiredness, stiff shoulders, headaches, and lower back pain more frequently than healthy subjects, but only the occurrence of stiff shoulders was significantly higher. Infirm subjects experienced significantly more pain at the beginning of the sorting season, though both groups experienced more discomfort at the beginning of the season than at the end. Prior work did not seem to affect the distribution or the onset of problems.

The subject groups did not differ with respect to sorting and holding hand preferences. About 60% of workers used the right hand for sorting, while only 13% used the left hand and 12% change hands. Both groups had comparable hand preference distributions; the majority were right handed and 8% were ambidextrous. However, infirm subjects did experience significantly more problems in their hands while wrapping. And, although both groups wear glove liners, a significantly larger proportion of infirm subjects experienced cold hands and muscle fatigue. Table III details workstation problems.

Table III. -- Workstation Problems

	Infirm	Healthy
Lighting		
Too High	9 (8)	10 (6)
Too Low	14 (12)	29 (18)
Working Posture		
Sitting	13 (11)	18 (11)
Standing	58 (49)	72 (46)
Both	46 (39)	65 (41)
Table Height		
Too High	4 (3)	9 (6)
Too Low	36 (31)	32 (20)
Worksurface		
Too Large	0	1 (1)
Too Small	38 (32)	55 (35)

Video analysis showed that workers experiencing health problems tended to deviate more frequently from the anatomically neutral position of the upper joints.

DISCUSSION AND RECOMMENDATIONS

Nursery workers are unique compared to other industrial workers in that they do not use any hand tools, they are seasonal workers, and the group of workers at the beginning of a season is usually a mixture of experienced and inexperienced workers. Additionally, the inability to predict when lifting and sorting will be done makes it difficult to establish an exercise program.

Occupational health problems in sorters are specific to the right wrist flexors, index and middle fingers, the right and left shoulders, and upper back areas. Infirm subjects are weaker in hand and finger strength at the beginning of the sorting season, deviate more frequently from the anatomically neutral upper joint position, and feel colder throughout the day compared to healthy subjects. Infirm subjects also feel that their workstations are too low.

The following three recommendations were developed:

1) A video training program should be used to assist crew leaders in training sorters. The video should emphasize good work methods and proper hand motions.

2) An exercise-gymnastic rest/pause program should be introduced. Exercises should use resistance (such as rubber tubing or hand squeezing) to develop upper limb strength.

3) Administrative controls should be applied to keep the sorting sheds warmer.