Comparison and technical evaluation of electrostatic, micronair and tractor-mounted lance sprayers in order to control (*Carpocasa pomonella* L.) in apple orchards

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Introduction

The efficiency and cost effectiveness of orchard pest management programs are influenced by the skills of managers and sprayer operators who evaluate orchard conditions and alter machine settings and operating techniques to optimize performance of sprayers. A combination of operational skill, equipment performance, timing and chemical selection is necessary for optimal results. Research and development of electrostatics, air-assisted, low-volume spraying and other technologies for agriculture and horticulture was studied by biological and agricultural engineering in order to decrease of pesticide consumption. The main objective of charged liquid or powder form of the pesticide spread is increasing the percentage of poison meeting on plant surfaces. The first sprayer with rotary plate became available in 1970. The amount of solution was less and had uniform spray droplets. Apple orchards in West Azerbaijan province, Iran, are sprayed mainly with tractor-mounted lance sprayers but there is large national, regional and farm to farm variation in spray volumes applied with such sprayers. Traditionally, high spray volumes (> 2000 l.ha⁻¹) were used in many places. Reduction in spray volume has been driven largely by the need to improve spraying equipment. West Azerbaijan province has 117000 hectare fruit orchards and 1.2 million ton fruit production that the most of them are apple and grape. However, it is necessary for reduction of pesticide application in order to produce economic and safe fruits.

Materials and Methods

In the present study the tractor-mounted lance sprayer in control of apple pest (*Carpocasa pomonella* L.) was evaluated and compared with electrostatic and Micronair sprayers. This research was implemented in an apple orchard (Golden Delicious variety) with row spacing of 6×6 meter. The experiment was conducted as a randomized complete block design (RCBD) with three replications. Statistical analysis was performed using MS-TATC software and mean comparisons were conducted by Duncan’s multiple range test. The location of the research was in an orchard around the city of Urmia with geographical coordinates of 10-45' and 24-37' north latitude and east longitude, average rainfall of 380 mm, average temperature of 10°C, relative humidity of 60% and an average wind speed of 3.4 m.s⁻¹. Average altitude of 1450 meters above sea level and has very high soil fertility and texture of silt loam class was the first class. In this experiment the following variables were measured: solution consumption, droplet distribution uniformity, pest control and economical comparison. Distribution uniformity was evaluated by use of water sensitive papers with dimension of 7×3 centimeter that installed in front and behind of leaves.

Results and Discussion

During the two-years study, results showed that uniform droplets on leaves in electrostatic and micronair sprayers with 30 drops per square centimeter were better than lance sprayer and in behind of leaves and electrostatic sprayer with 16 drops per square centimeter had better coverage. In lance type, large droplets and non-uniform distribution on the front and back of the leaves were observed. The mean comparison of solution consumption of treatments showed that electrostatic and microner sprayers with 157 and 134 liters per hectare, respectively, were in the range of low volume spraying (from 50-200 liters per hectare) and lance sprayer with 1629 liters per hectare was in the high volume spraying (more than 200 liters per hectare). Economically, the results showed that the micronair sprayer with high cost-benefit ratio (315.7) was recommended. Low volume

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spraying of apple trees is achievable by the use of spray technology such as micronair sprayers and provides considerable advantages in spray volume reduction.

Conclusions

Pesticides are active substances and instead of drenching of targets with lance sprayers we can change this poor and high expensive method with effective and environmental friendly methods. The technical evaluation showed that electrostatic and micronair sprayers were significantly better with more spray uniformity, higher performance, and lower consumption of solutions. Replacing the traditional methods with minimal use of chemicals and new equipment can improve the quality of agricultural and horticultural crops in national production contribution.

Keywords: Apple pest, Distribution uniformity, Liquid consumption, Spraying