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EXAMINATION OF FAN FLAT NOZZLES TECHNICAL CONDITIONS AFTER LABORATORY WEAR

Abstract:
Working parameters of fan flat nozzles which affect drop tracks size were the subject of the study. New nozzles and nozzles after laboratory wear were tested. The influence of nozzles wear on drop tracks size were examined. It was found that increase in liquid flow rate results in higher values of mean diameter of drop track. Then increase in working pressure or working speed respectively cause decrease in drop tracks size and reduce merging of drops on spray surface. Increase in wear degree was followed by increased coverage rate. This phenomenon is especially dangerous then using nozzles with a considerable degree of wear for agricultural spray since it ecological threat to the environment.

Keywords:
spray, nozzles wear, flow rate

INTRODUCTION

Chemical plant protection is nowadays the basic method of effective eradication of agrofags. In consequence, competent use of plant protection agents rises in importance, i. e. maintaining their effectiveness and reducing threat that such agents pose both to natural environment and people's or animal's health. Due to rising requirements to reduce environmental pollution and costs of agricultural production it is important to use pesticides with appropriate precision.

It should be noted that spray quality is primarily determined by the degree of nozzle wear [Gajtkowski 1985]. Nozzle wear rate depends on outlet size and material a nozzle is made of [Wargocki 1995]. Moreover, higher degree of nozzle wear affects the degree of drops merging, which facilitates their following off the surface of protected plants and infiltration into subterranean water, and this, in turn, causes environmental contamination. If drops generated by a nozzle are very small, they are drifted by wind and liquid evaporates before reaching protected plants.

METHODS

The aim of this study was to determine the influence of changes of agricultural nozzles technical condition on obtaining appropriate drop tracks size.

New nozzles (LECHLER 110-03) of nominal flow rate 1,17 $l*min^{-1}$ were destroyed by 3 bar pressure. A testing stand with sprayer boom *speeds of 5 km/h (1,39 m/s), 7km/h (1,94 m/s), 9 km/h (2,50 m/s) was usede for drop placement on a model surface. The model surface consisted of film strip of the size 100 x 10 cm Measurements were recorded at the pressure of 1 bar, 3 bars, 5 bars. The nozzles were destroyed to reach 5 and 10% wear rates, which was calculated by comparing changes in liquid flow rate from each nozzle to nominal flow rate. Water solution of kaolin was used for destroying nozzles. 9.8 kg of kaolin were added into 150 l of water [Ozkan et al., 1992]. The following ranges of drop track diameter were taken for evaluation:*

- *< 150 μm,*
- *150 ÷ 250 μm,*
- *250 ÷ 350 μm,*
- *350 ÷ 450 μm,*
- *> 450 μm.*

After drying up of the drops 5 images of the size 5 x 5 cm were scanned from each film strip. The first image was scanned in the nozzle symmetry axis, and the 10 and 20 cm on the lefy and right sides of such an axis. Drop track diameter, spray coverage degree and number of drops were calculated using the computer programme Image Pro+ made by Media Cybernetics.

RESULTS

The analysys of the tests results revealed that increase in working pressure and working speed coincided with reduction of mean diameter of drop tracks sieze (Figure 1)

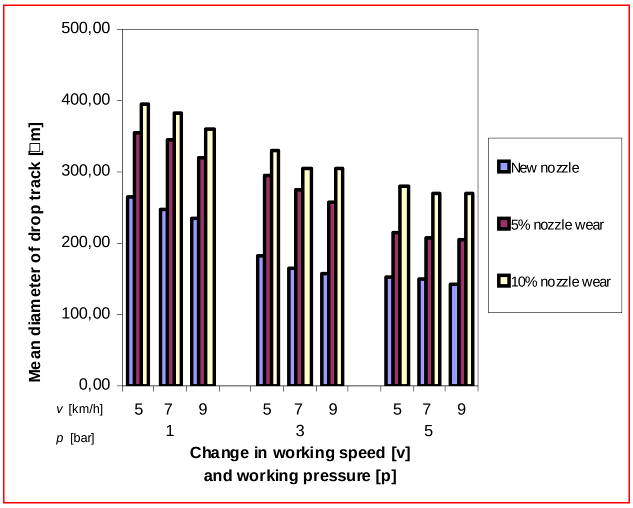

Fig. 1. Change in mean diameter of drop track as a function of working pressure (respectively for new nozzle and 5% and 10% wear rates).

Increase in working speed causes separation of individual drops falling on the spray surface, reduces their merging, but simultaneously reduces liquid dose per hectare.

The test results of coverage degree as a function of changes in working pressure and working speed were presented in Figure 2. A rise in working pressure increases coverage degree. This happens because higher working pressure makes a nozzle produce smaller drops despite its wear.

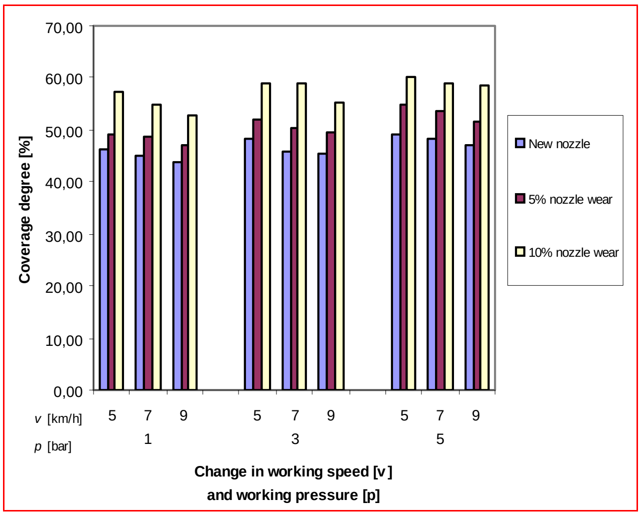

Fig. 2. Change in coverage degree as a function of changes in working pressure (respectively for new nozzles and 5% and 10% wear rates).

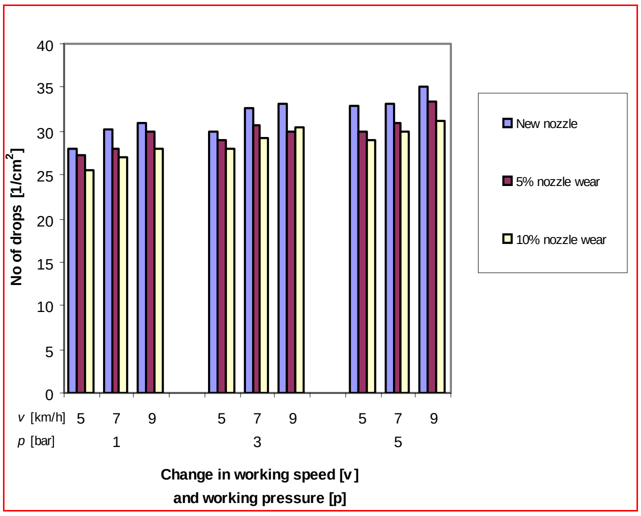

Fig. 3. Change in the number of drops per 1 cm^2 as a function of changes in working pressure (respectively for new nozzle and 5% and 10% wear rates).

A worn nozzle, in turn, doses a higher volume of liquid, and consequently coverage degree increases. A rise in working speed was found to coincide with a decrease in coverage degree.

Excessively low pressure or slow working speed cause the merging drops. This process is especially dangerous while performing the plant protection spray with nozzles with a higher wear rate. Figure 3 shows graphic interpretation of the results concerning the number of drops per 1 cm^2 as a function of changes in working pressure and working speed.

CONCLUSION

Increase in nozzle wear degree causes changes in drop tracks size left on spray surface. Excessively low pressure or slow working speed cause merging of drops. This process is especially dangerous while performing plant protection spray with nozzles with high wear rate. High working pressure in nozzles with low flow rate as well as using of worn-out nozzles cause deterioration of working parameters of agricultural spray as respectively these increase the number of drops of smaller diameter or make liquid flow off plants surface.

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