Researches Regarding the Influence of Pressure on Uniformity of Distribution for New Types of Nozzles

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Abstract: The efficiency of plant treatment depends on a number of factors such as: substance used for treatment, hectare dosage compliance, optimum period of application and the type of nozzle with which the machine is equipped. In this paper we determined how pressure affects the uniformity of distribution for different distances between the nozzle and the target surface using Syngenta Hypro Defy nozzles.

Keywords: Syngenta Hypro Defy, uniformity of distribution, testing equipment, variation coefficient

INTRODUCTION

Increasing the efficiency of plant treatment and reduction of environmental pollution can be achieved through the improvement of the machinery components, in particular of the spray nozzles.

Misapplication of pesticides contributes to environmental pollution. Studies carried out in different countries shows that most of the pesticides used in the field evaporates and the drift phenomenon often occurs as a result some of the applied pesticides can be found the air far away from the site of application.

Reduce environmental pollution and simultaneously increasing efficiency of phytosanitary treatments demands the need to correct existing practices and using new types of nozzles mounted on machine performance. These spraying machines apply treatment solutions ensuring better coverage especially in contact substances.

Worldwide manufacturers of control substances in cooperation with machine manufacturers are working towards reducing the amount of substance applied per hectare and ensuring the use of biodegradable and performance machines equipped with nozzles that ensure good spray coverage and reduce drift phenomenon.

In this research we focused on HiproDefy 0.35 nozzles mounted on the EEP - 600 ME machine, observing how pressure affects distribution uniformity.

MATERIALS AND METHODS

For experimental tests the EEP-600 ME machine was used which complies with the European requirements and is equipped with control electronics which can change the operating pressure from cabin using a computer process.

Syngenta HyproDefy nozzles are relatively new; they are not included in the nomenclature of ISO nozzles (Fig.1). Thus in this work we wanted to determine optimal pressure distribution so that uniformity is maximized.
These nozzles have the following characteristics:
- top angle of the spray cone - 83°
- flow rate -0.35 gallons/minute at 2.8 bar pressure
- vertical jet inclination - 38°
- maximum working speed - 16 km/h

These nozzles can be mounted on the ramp with the jet oriented in the same direction (Fig. 2) or alternatively (Fig. 3) one forward and one reversed (rotated 180) in respect with the travelled direction, case in which there is better coverage of plant with solution.
Uniformity of distribution was determined using TEST 1000 equipment of the Department of Agricultural Machinery which has the software to indicate the variation of uniformity of distribution curve and uniformity coefficient of variation of the distribution width.

Experimental tests were carried out at 7 pressure (1, 2, 3, 4, 5, 6, 7 bar) and four hights (30, 40, 50 and 70 cm).

Distribution uniformity assessment was made using the coefficient of variation (CV) shown on the computer monitor with a variation diagram uniformity of distribution.

RESULTS AND DISCUSSIONS

After collecting data from experimental tests and their statistical processing graphs were drawn regarding uniformity distribution coefficient of variation, polynomial curve and the correlation coefficient was determined.

For the 30 cm nozzle height to the target, the results are presented in Fig. 4.
At the height of 30 cm is found that at a pressure of 1 bar the uniformity is high uniformity coefficient of variation exceeding the permissible limit and therefore is not suitable to work in these conditions.

Maximum uniformity is obtained at a pressure of 4 bar but also at this pressure the coefficient of variation is closer to a value of 9.

Increasing the pressure up to 7 bar determines again the decreasing of the uniformity of distribution.

Fig. 5. Influence of pressure on the uniformity of distribution at a height of 50 cm

Lifting the ramps to 50 cm (Fig. 5), the pressure ranges between 2 and 5 bar assures good uniformity of distribution, the coefficient of variation having values between 4 and 7, reaching a minimum of 4.62 to a pressure of 2 bar (Fig. 6). Outside this range the pressure distribution uniformity is unacceptable. The coefficient of determination is greater than the height of 30 cm.

Fig. 6. The coefficient of variation at height of 50 cm and a pressure of 2 bar

At the height of 60 cm (Fig. 7) uniformity of distribution is good at a pressure between 1 and 5 bar to the maximum value at a pressure of 2 bar. By working at greater
pressures uniformity decreases. Also the high coefficient of determination is set to more than 0.8.

![Graph showing distribution uniformity at 60 cm height](image)

**Fig. 7.** Influence of pressure on the uniformity of distribution at a height of 60 cm

At the height of 70 cm from the target surface (Fig. 8), it appears that distribution uniformity is good in the pressure range of 2 to 5 bar, the lower value of the coefficient of variation is obtained at a pressure of 3 bar (2, 96) and at pressures above 6 bar and under 2 bar the uniformity is inadequate.

![Graph showing distribution uniformity at 70 cm height](image)

**Fig. 8.** Influence of pressure on the uniformity of distribution at a height of 70 cm

CONCLUSIONS

1. As a result of experimental researches is found that Syngenta Hypro Defy nozzles are nozzles that can be used for low pressure treatments. The coefficient of variation expresses the uniformity of distribution was the lowest pressure between 1 and 4 bar.

2. Syngenta HyproDefy nozzles can be used to successfully execute plant protection treatments, their uniformity is good for the pressure range prescribed by the manufacturer. To obtain good and very good distribution uniformity, the working pressure must be within the range 1-4 bar.
3. After experimental tests it was observed that when using Hypro nozzles Syngenta Defy 0.35 at low height from the surface target distribution uniformity is unacceptable, being not suitable to work with machines phytosanitary treatment in these conditions.

4. At the operating pressures between 2 and 5 bar, is desirable to provide a nozzle to a height of 50 - 60 cm from the target surface. From the graphs obtained on the basis of the operating pressure used one can select the height to obtain maximum uniformity of the distribution.

REFERENCES


