DOCUMENTARY RESERACHES UPON THE TECHNOLOGIES AND MACHINES FOR PLANT PROTECTION IN CORRELATION WITH THE ECOLOGICAL STRESS (I)

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Abstract. The present paper (divided in two parts) is dedicated to the environmental protection in the chemical treatments in agriculture. Actually environment protection has a major importance at the society level considering the impact of the economical activities that took place in the ambient space in which we live. An analysis upon the environment protection starts with the equation: Ecological stress = K x economical development (k - proportionality factor). According to this equation we can conclude that the avoiding of the ecological stress lead to the development of less polluting technologies for plant protection and pesticides spreading.

Keywords: ecology, agricultural technologies, ecological effect

INTRODUCTION

The pollution costs can be definite as being [1]: costs due to the direct damages (damaged crops, professional illnesses etc.); socio-economical costs (ecological reconstruction, protection equipments etc.); costs for the pollution reduction according the regulations; costs related to the controlling and monitoring of the pollution. It can be established a correlation between the level of crop production and the level necessary expenses for environment protection. These costs are influenced by the admissible pollution degree according the regulations (fig. 1).

![Fig. 1 Technological costs for pollution reduction](image)

It can be established an index for the environment quality evaluation, that will take values in the (0, 1), 0 corresponding to the irreversible pollution level and 1 to the clean environment.
\[ I_{qe} = \frac{C_{A_{\text{max}(i)}} - C_{\text{ef}(i)}}{C_{C_{\text{max}(i)}} - C_{A_{\text{max}(i)}}} \]  

where: 
- \( I_{qe} \) is the individual environment quality index; 
- \( C_{A_{\text{max}(i)}} \) - maximum concentration for the "i" pollutant; 
- \( C_{C_{\text{max}(i)}} \) - maximum concentration for the "i" pollutant that leads to the irreversible environment degradation; 
- \( C_{\text{ef}(i)} \) - effective concentration for the "i" pollutant (at the measurement moment).

The analysis of the machines functional parameters in relation with the ecological demands will be done according the working principle and destination. The majority of the spraying machines are working on the following principles: hydraulic with adjustable jet; hydraulic with projected jet; hydro pneumatic jet.

**MATERIAL AND METHOD**

Actually there is a large variety of spraying machines, but all of them have a common basic structure at which is added the corresponding spraying devices according to the crop requirements (fig. 2). So, a machines for pesticide spreading, in the case of field crops are equipped with a hydraulic with projected jet spraying device (type A), or with air hydraulic jet system (type B or C). In the vineyards and orchards there are used hydro pneumatic jet (type E).

![Fig. 2 Basic scheme of the technological system of spraying machines](image)

1 - pesticide tank; 2 - water tank; 3 - washing water tank; 4 - two ways stopcock; 5 - admission filter; 6 - three ways stopcock; 7 - two ways stopcock; 8 - filling connection; 9 - two ways stopcock; 10 - filter; 11 - distribution body; 12 - pressure gauge; 13 - command stopcock; 14 - working lines; 15 - centrifugal pomp; 16, 17 - two ways stopcock; 18 - ejector; 19 - two ways stopcock; 20 - washing system; 21 - agitator; 22 - agitator line; 23 - filling line; 24 - system for the solution preparing; 25 - centrifugal ventilator; 26 - axial ventilator

The hydraulic system for the spray jet development is designed to mount on the ramps of the distribution of pesticides in the case of the field crops using the simple or double circuit [3]. In the first case the pressure level in the machine lines are uncontrolled and so the pesticide debit is uncontrollably, having so an important influence on the allotment uniformity on the working ramp width. This system is used mainly in the case of the machines with a 12 m width. Assembly distribution system with double circuit has the advantage of reducing the losses of pressure on hydraulic circuits, because control of working pressure in the system is made to return the solution into the tank through a
calibrated circuit. Spraying bodies with drip-stop valve, equipped with jet nozzles, at which the flow rate range deviation from nozzle to nozzle is not more than ± 5% (NF-26-110 °) relative to the average flow of the entire distribution system. Nozzle type changes in conjunction with the work performed. So LU-120° nozzle-05 (LECHLER) jet plane and angle to 120° tip is used universally, for wind speed up to 3 m/s, at pressures ranging from 1 to 5 bar.

LECHLER nozzle AD-120-04 with jet plane and derive limited, have medium drops (300-400 µm) and large droplets (700-800 µm). LECHLER nozzle AD-120-04 jet plane and derive limited, drops (300-400 µm) and large droplets (700-800 µm). Variation in the size of the droplets is achieved through variation of the flow section headroom in the pill. It can be used up to wind speeds of 5 m/s and working pressures of 1 to 6 bar. Both LU-120° nozzle-05 and AD-120° nozzle-04 are made of ceramic or plastic. ID-120 ° nozzle-03 (LECHLER-air injection), jet plane and angle to 120° peak working pressure between 3 and 8 bar and can be used up to a wind speed of 8 m/s, with reduced leakage on the surface of leaves and very low drift phenomenon. All these nozzles are made of ceramic materials and plastics [5]. The marking of these nozzles is: peak by 120° (the angle the jet plane), and 03, 04, 05 refers to the rate of flow in tenths of a GPM (1GPM = 3.8 l / min at a pressure of 40 psi, 1 psi = 0.07 bar). Therefore, the nozzle 120 ° LU-05 has a flow rate of 0.5 GPM, i.e. 1.26 l / min at a pressure of 2.8 bar.

In U.K. the classification of spraying equipment and processes, in terms of reducing the potential for drift is based on comparison with drift nozzle produced by a reference: F 110 / 1.2 / 3.0. Depending on the degree of drift reduction is given a number from one to three "stars LERAP for reduced drift". (LERAP-LowDrift Stars, LERAP=Local Environmental Risk Assessments of Pesticide).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Drift level (compared with the reference value)</th>
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<tbody>
<tr>
<td>No star „LERAP-LowDrift”</td>
<td>Drift value higher than 75%</td>
</tr>
<tr>
<td>LERAP-LowDrift-one star *</td>
<td>Drift value 50±75%</td>
</tr>
<tr>
<td>LERAP-LowDrift-two star **</td>
<td>Drift value 25 ± 50%</td>
</tr>
<tr>
<td>LERAP-LowDrift-three star ***</td>
<td>Drift value lower than 25%</td>
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As the German classification drift reduction classes, LERAP star ratings is a quality criterion and advertising argument. Among the first sprayers which have been granted a number of 3 star LERAP (LERAP-LowDrift-three star ***) include nozzles ID AD 120-03 and 120-04 manufactured by Lechler. Currently these nozzles are certified based on different methodologies, as appropriate to reduce drift in both Germany and the UK. In the case of the spray system with intake air (HardiTwin, Figure 4), the spray ramp is equipped with a hydraulic circuit tangential swirl chamber nozzle, and a circuit constant volume of air discharged by axial fan, by means of bellows the entire length of the ramp; Tangential nozzles are mounted at a distance of 25 cm and air distribution holes are sized bottles of 15-20 mm and are practiced at a distance of 25 cm; the direction of travel of the machine is to ramp the bellows hydraulic spraying; angle of entry of the jet of droplets in the air stream is adjustable; the space between the two jets (air and liquid) is created a vacuum, which causes a displacement of the droplets in the air stream, the air stream was stirred plants and allow the penetration of the droplets to the base thereof; air flow also serves to reduce the phenomenon of drift, by limiting the movement of droplets.

INFLUENCE OF THE BOOM STABILITY UPON THE HERBICIDE DISTRIBUTION UNIFORMITY

During herbicide application in field crops, spraying ramps are subjected to various stresses, that translate through the motions of rotation in the vertical plane and horizontal oscillations. A consequence of these movements is uneven distribution of the solution during the treatments, with the emergence of areas up doze or under doze and so with an uncontrolled environmental impact. Spray boom movements can be understood through a study of the mechanical components from the Assembly's structure spraying equipment.

For the maintaining of the spraying ramps in a stable position, parallel towards the soil surface, installation on the machine spraying is done through a system of constructive shapes swinging in conjunction with working width and according to type of machine. Besides the possibility of positioning the parallel to the soil surface is used the position "geo-variety". This solution allows independent adjustment of the constructive position of each section of the ramp, in part, toward the ground. In this way it is possible to copy better bump, as is the case of sprayed on hills or narrow valleys. Uniformity of the distribution of solute per unit area is influenced by the movement of the machine and the spraying system mounted on the ramp. The longitudinal uniformity of distribution of the solution is ensured by linking the speed of-forwarding of the machine with the flow of the spray solution, by equipping it with various types of verification and control. In the transverse plane, making a correct choice of the types of nozzles which shall be fitted with ramps, which in turn requires a periodic verification of uniformity of distribution because they, during the process, you can decalibrate it as a result of increased wear or deformation of the hole through a cleaning with blunt objects.

Determination of the solution distribution uniformity in the transverse plane can be done in two ways: from stationary, with horizontal ramp with a sloping platforms with gutters with step of 50 mm or 100 mm, at which the solution is seals in cylinders graduate; on a simulation able to replicate the terrain slopes tractor wheels, the plot of the work. For carrying out such tests, surface treatments intended for sprayers fitted with ramps, shall be of the same type and do not have a debit difference greater than 5% compared to the average flow of the ramp if nozzles with slot and 10% in the case of nozzles with tangential twirl room constant.
Fig. 4. Transversal distribution profile for a pad sprayed with width 6 m, equipped with jet nozzles type plan AD-120-04

Mounted in series on sections of pulverisers, jets products overlap, such that the lateral distribution uniformity in quality and quantity no longer corresponds with the lateral uniformity of distribution of a single spray. Variation coefficient (CV) is determined by the relationship [2, 3]:

$$CV = \frac{S}{\bar{X}} \times 100 \% \quad (2)$$

where: $S$ is the standard deviation;

$\bar{X}$ - the average quantity of abstracted, it solution.

$$S = \sqrt{\frac{\sum (x_i - \bar{X})^2}{n - 1}} \quad (3)$$

REFERENCES