

TESTING OF THE SPRAYING MACHINES- PREREQUISITE FOR HIGH QUALITY PHYTO-PHARMACEUTICAL TREATMENTS

VERIFICAREA MASINILOR DE STROPIT- CONDITIE ESENTIALA PENTRU TRATAMENTE FITO-SANITARE DE CALITATE

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Abstract: *In this paper are presented two stands for testing characteristics of spraying machines, respective the uniformity of distribution, regarding spraying quality increase. The quality of a phyto-pharmaceutical treatment made by spraying liquid is determined both by treatment efficiency in point of pest extermination and by reduction of the pollution of the environment. Improved and maintained level in farming product and equipment quality forms a basic component while aligning with the requirements in this domain of the European Union.*

Rezumat: *În această lucrare sunt prezentate două standuri pentru verificarea mașinilor de stropit, respectiv a uniformității de distribuție, din perspectiva creșterii calității stropirii. Calitatea unui tratament fito-sanitar prin pulverizarea soluției este determinată atât de eficiența din punct de vedere al distrugerii daunatorului cât și din reducerea riscului de poluare a mediului. Creșterea și menținerea nivelului calitativ al produselor și echipamentelor tehnice destinate agriculturii constituie o componentă de bază a politicii de aliniere la exigențele Uniunii Europene*

Key words: *testing stand, spraying machines, phyto-pharmaceutical treatments, environmental protection*
Cuvinte cheie: *stand de verificare, mașini de stropit, tratamente fito-sanitare, protecția mediului,*

INTRODUCTION

The agricultural production system is made up of three tightly connected: resources, technology and environment. The types of technology made available for the farmers and their opting in for a certain type of technology depend upon the quantity, quality and access to resources. The technology applied, in its turn, can induce damage to the environment and consequently, it affects the access to resources in the future.

The concept of sustainable agriculture or farming, where a fundamental condition is represented by the resources preservation, also admitted as an alternative to conventional agriculture, promotes the rational use of resources concomitantly with providing for productivity, profitability and environment protection.

Crop protection shall be carried on high level to avoid environmental damages and to ensure food and operator safety. High quality of spraying equipment inspection is a prerequisite for risk reduction to prevent a possible adverse impact on the environment and on human health.

The diminishing of the environment and operator pesticide contamination risk can be achieved by using more means, such as: developing the professional competence of the operator in charge with the works of pesticide spreading, using lower toxicity and biodegradable pesticides, and using proper spraying equipment having parameters complying with the aim established.

“The key” to apply a minimum amount of pesticide with a maximum efficiency is given by the right correlation of the two elements *the machine and the application system*, function of the specific conditions in the area. “The machine” that is used for the pesticide

application should preserve the functional features all along the service period in order to maintain the efficiency and efficacy of the treatment and that related to the surrounding environment.

MATERIALS AND METHOD

During recent years, when the accession process has become speedier, CEN (European Committee for Standardization) has adopted some European Standards and Norms concerning the spraying equipment for the application of the plant health treatments, such as : EN 907/1997- about sprayers safety ; EN 12761/2001-about sprayers – environmental protection ; EN 13790/2003 about inspection of sprayers in use.[1][2][3]

The provisions in the norms mentioned lead to the compliance between the national and European norms in the field and to the uniform standards to be implemented. The majority of the European Union developed countries concerned with a green and sustainable farming activity have included in their regulations the periodical checks of the equipment, after a certain number of operating hours, according to a specified procedure, aiming at defining the conformity of the functional characteristics with the specifications.

In order to have an overall view concerning the present-day stage in the control of plant health protection equipment, Table 1 shows the organisation and working system used in some European countries, whether or not belonging to the European Union.

Table 1

Inspection of field sprayers in the European Countries [4]

Country	Mandatory check since	Voluntary check since	Number of equipment in use	Number of sprayers inspected (average 2004-2006)	Number of years after which the check is repeated	Costs (Euro)
Belgium	1995	1989	19031	6344	3	12-142
Denmark	1993	-	30000	151	-	-
France	-	1990	200000	-	-	100-250
Germany	1993	1976	130.100	72809	2	55-341
U.K.	-	1997	44000	8790	1	100-650
Greece	-	-	45089	-	-	-
Italy	1999-2001	1988	200000	2300	1 to 5	0 to 206
Spain	-	1990	70000	300	4	25-100
Sweden	-	1987	19000	1700	2	1740
Holland	1997	1976	13000	5751	3	120-200
Hungary	-	-	30000	-	2	110-130
Lithuania	2001	-	15000	281	3	28-86
Norway	2006	1991	16800	1950	5	180-300
Poland	1999	-	299399	60500	3	33-42

In this inspection to which the equipment is subjected, the following components are checked by visual inspection or by measurements: the pump operation, the stirring system, the tank and pipes state, filters, fan, nozzles, the distributor the regulating and measurement system components. When this equipment is inspected, the pump output, the pressure, the output of a nozzle, the uniformity between nozzles, and the fan rotation speed are measured. When the

equipment works well, such checks do not have spectacular effects, but in the case of defective spraying machines the positive effects are considerable:

- increased spray quality and implicitly, the diminution of the pesticide amount applied, diminished work costs and a reduction of the pollution of the environment;
- removing the improper equipment from marketing;
- improving the working conditions of the operating personnel.

Having in view our country's legislative harmonization with the regulations in the EU, the need to set up a technical framework for the pesticide spraying equipment, the team has made a method and has produced two stands that aim at an accurate determination of the technical properties of the equipment used when treating crops and vines and orchards by spraying.

STAND USED FOR CHECKING THE UNIFORMITY OF DISTRIBUTION OF THE FIELD CROP SPRAYERS

The stand tested and used to check the uniformity of distribution of the field crop sprayers presented in operation in fig.1, has the following characteristics:

- Overall dimension, LxWxH, 1100x1000x450 mm;
- Liquid collecting plate, of 1m² surface;
- Test tube holder with 10 test tubes of similar volume;
- Rail path, 11 segments of 2m lengths;
- Electronic system for data acquisition, transmission and processing



Figure1. Checking the uniformity of distribution of the EEP 500 equipment with the stand designed by INMA

The stand that is an easy to move modular construction of small dimensions made of anticorrosive material, allows obtaining and registering the values for nozzle flow rates and variation of distribution uniformity on the working width.

STAND FOR TESTING THE CHARACTERISTICS OF THE EQUIPMENT DEDICATED TO PLANT HEALTH PROTECTION TREATMENT IN VINEYARDS AND ORCHARDS

The stand for testing the characteristics of the air-assisted sprayers for vineyards and orchards (fig.2) provides the measurement of the technical characteristics of the attached and hauled equipment, that is equipped with up to 16 nozzles, is used for the plant health protection treatment against diseases and pests in vineyards and orchards by spraying insecticide and fungicide substances.

The main technical characteristics of the stand testing the properties of the air-assisted sprayers for vineyards and orchards are presented below:

- Dimensions, LxWxH, 1150x550x1000 mm
- Collecting test tubes, of constant volume, 16 pieces.
- Supply source- direct current 12V,
- Electronic system for measurement, control and data acquisition;



Figure 2. Testing the functional parameters of an air-assisted sprayer ATOM 1000, with the help of the stand built

The determination of the flow rates per nozzles, in the case of this stand too, is based upon the measurement of the time needed to fill in constant volumes.

The whole structure of the stand is built with anticorrosive material, has small size, is easy to move and enables getting values and recording them for the flow rates per nozzle and for the flow rates uniformity variation.

RESULTS AND DISCUSSION

Regarding the stand used to check the uniformity of distribution of the field crop sprayers tested parameters are: the working pressure, the uniformity of distribution over the working width; the nozzle flow rate; application rate.

The operation of the stand is based upon the principle that the determination of the nozzles flow rate is measured and calculates on the basis of the times necessary for filling of similar volumes. The results are displayed and printed in a table and a graph form in a Test Bulletin (fig.3)

The tested parameters of the stand for testing the characteristics of the air-assisted sprayers for vineyards and orchards are: the working pressure, the nozzle flow rate, the uniformity of flow rates, application rate. Following the data in the files with the measured values processing, a test bulletin (fig.4) is produced, plotting the variations of the output, the average output is then calculated as well as the minimum and maximum deviations from this value, the variation coefficient and the amount of solution to be used per hectare.

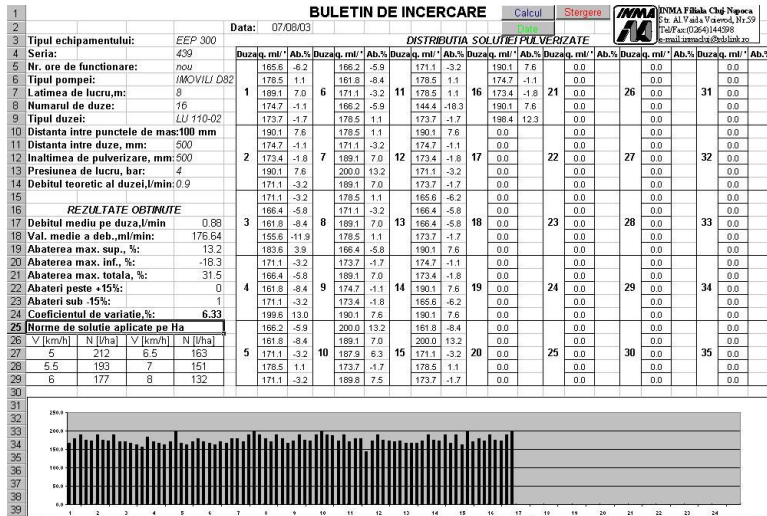


Figure 3. Test Bulletin produced at testing an EPM 500 equipment

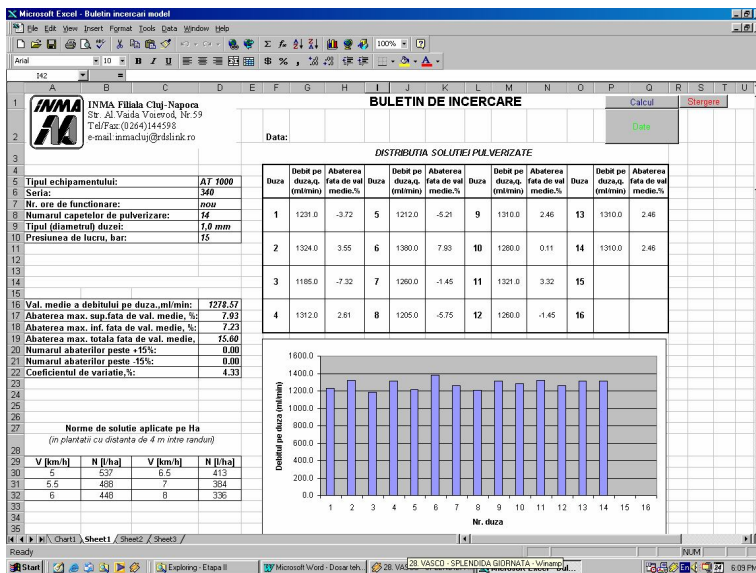


Figure 4. Results of the tests for the equipment ATOM 1000

CONCLUSIONS

The two stands present small dimensions so that their transportation can be made with a small pickup truck or car. This feature enables the displacement to the technical equipment owner in view of tests and determinations for spraying machines.

The automated electronic measurement, control and data acquisition equipment contributes to a higher measuring accuracy, shorter time length for the sampling and increased confidence in the measurement values reached.

Considering the fact that the entire equipment is going to be used in a wet, strongly corrosive environment, the product was made of polypropylene having proper mechanical properties for the required demands and for resistance to corrosion. The advantages of these stands for the testing and checking consist in: increased measuring accuracy, reduced trial time, increased reliability of results, automated printout of the Test bulletin including the test results, easily used in the field.

The functional and constructive solutions adopted in the case of these stands are similar to other products of the kind, to be found internationally.

BIBLIOGRAFY

- 1.XXX, AGRICULTURAL AND FORESTRY MACHINERY – Sprayers and liquid fertilizer distributors– Safety, European Standard (EN) 907/1997
- 2.XXX, AGRICULTURAL AND FORESTRY MACHINERY- Sprayers and liquid fertilizer distributors- Environmental protection, European Standard (EN) 12761/2001,
- 3.XXX, AGRICULTURAL MACHINERY- SPRAYERS – Inspection of sprayers in use, European Standard (EN) 13790/2003,
- 4.XXX, MITTEILUNGEN AUS DER BBA, SPISE 2, vol 412, Germany, 2007