SOME OF THE POSSIBILITIES OF REDUCING PESTICIDES BY APPLYING SPRAY TECHNICS

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Summary

We started to make experiments four years ago with different types of Hungarian and import sprayers in the frame of OTKA project. The project number is T-042594 titled: „The possibilities of reduction of pesticides by spray technology".

Test results in plantations proved the advantages of using of new technology methods compared to the using of traditional sprayers. The modern methods yielded more favourable pesticide deposition on the leaves besides the application of the same quantity of pesticides than the traditional sprayers.

The coverage was proper when we reduced the doses of spray so that we could work with less quantity of pesticide.

Introduction

In the interest of safeguarding crops there will probably be need for applying chemical environmental protection processes.

It is true that plant protection processes continuously change, however, the basic duty of spraying remains unchanged: suitable agent should get to the target surface in the appropriate time, quantity and distribution, as a result of which the pathogens and pests can only be kept under an ecologically and economically determined level in the plant stock needing protection.

Nowadays, however, the proper basic requirement for the principle sustainable development would be to get the necessary minimum amount of active agents into the environment only to exterminate the determined number of the species of parasites, to prevent the diseases from spreading, with the least possible environment burden.

This objective is only realised in a small degree in the present plant protection practice. Half of the sprayed agent does not often reach the to-be-protected target surface and according to certain bibliography sources only approximately 1% of agent in each case brings about the killing of pathogens and pests.

This fact seems unbelievable, but it is acceptable if we think of the spray liquid and the quantity that reached the vegetation, or of the sprayed agent and chemical quantity resulting in the killing of the pests at the time of spraying.

According to different source data the utilisation of the sprayed pesticide in the recent years in our country is approximately 30-40,000 tons/year, thus there is tremendous economic and ecological importance of every plant protection technology nation wide, which assures the demanded effect biologically as well, besides the reduced agent doses.

In spite of the environment friendly methods, the significant pesticide and other cost reduction, however, it can be experienced that the up- to-date chemical saving, environment friendly, and plant protection technologies have not been widespread in home practice.

We started to make experiments with different types of Hungarian and import sprayers in the frame of OTKA project: „The Possibilities of Reduction of Pesticides by Spray Technology" and numbered T-042594 four years ago.

Objective of the research work: to promote home widespread of chemical reducing, environment friendly and plant protection technology by the approach of technologies producing diversities in the accumulation of the aimed surface, under the given outdoor circumstances.

In the frame of the project we compared the work of more plantation sprayers made in Europe and Hungary. In the last year of the project we compared the work of a made-in-abroad plantation spraying machine with a similar category of a homemade spraying machine with plant sensor, in all the cherry plantations.

We carried out the examination according to the domestic standard of FVM MGI (Hungarian Institute of Agricultural Engineering) plantation sprayers.

1. Examination material and method

The character of the examination:
comparison examination
To be completed examinations:
determination of coverage characteristics, and
control of pesticide saving.
Steps of the coverage examination:
- recording the examination circumstances,
- presentation of the examined machines,
- description of target surface, plantation,
- recording the parameters of machine setting,
- placing water sensitive test papers,
- completing spraying operation,
- collecting the test papers,
- determining the coverage characteristics, and
- evaluation of examination results.

The steps of controlling pesticide reduction:
- recording the examination circumstances,
- filling up the tank with the given amount of pesticide,
- spraying the pesticide,
- re-measuring the remaining pesticide,
- measuring the section length of the sprayed plantation with the given amount of pesticide,
- determining the pesticide doses,
- evaluation of examination results.

2. Examination results

2.1. Coverage test in apple plantation

We carried out recently our examinations laying out the foundation of the spreading of modern plant protection machines with the comparison of the traditional spraying methods and of the electrostatic drop filling in different plantations. During the earlier examinations we determined the coverage values, but the coverage noticeable on fruit is also an important parameter.

Coverage examinations were carried out on apple fruit too, at the research station of GYDKFV Újfehértó, the earlier spot of leaf coverage examinations. Figure 1 shows the average coverage values determined on sample series taken from the segments of 12 leaf crowns.

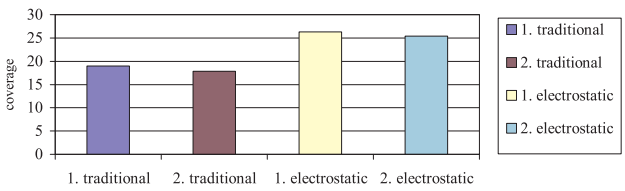

Figure 1. The formation of coverage values during the electrostatic drop charge spraying and without change spraying (traditional) on apple fruit

The average coverage on the leaves was similar during the electrostatic charge and the without charge spraying, but the coverage values per the segment of the leaf crown during the electrostatic charge spraying were more uniform. The coverage values determined at apple fruit changed from 18.5% to 25.8% on the effect of the electrostatic drop charge. Taking into account that the examination was carried out on 30 September, still before the picking period of apples, the increase of spray deposit on the target surface was particularly significant.

The result of the application of the traditional hydraulic drop formation technology and of the electrostatic drop charge spraying can be seen in figure 2 and 3.

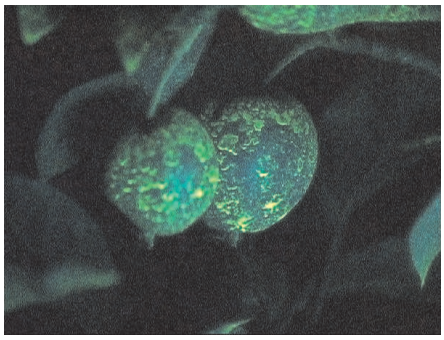

Figure 2. The coverage by traditional spraying

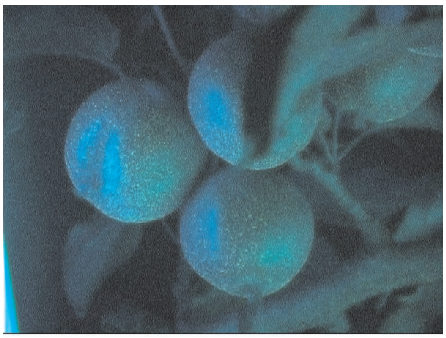

Figure 3. The coverage by electrostatic drop charge spraying

2.2. Examination results in cherry plantation

Recording the examination circumstances:
Character of exam: comparison examination
Place of exam: AGROROYAL Kft., Heves
Date of exam: 26 July 2007
Machines used: KERTITOX BORA equipped with plant sensor (Figure 4)
VULKANO without plant sensor (Figure 5)

Figure 4. KERTITOX BORA axial fan spraying machine equipped with plant sensor

Figure 5. VULCANO axial fan spraying machine

Results of the coverage examinations

The examinations were performed with applicable similar pesticide doses determined by the technical characteristics of the spraying machine.

It may be highlighted on the basis of the derived examination results that the abaxial leaf surface coverage during the plantation spraying with much lower than usual pesticide doses of about 250 dm3/ha applied was also suitable in the case of KERTITOX BORA spraying machine. It is significant because the pathogens and parasites can be usually found on the abaxial leaf surface

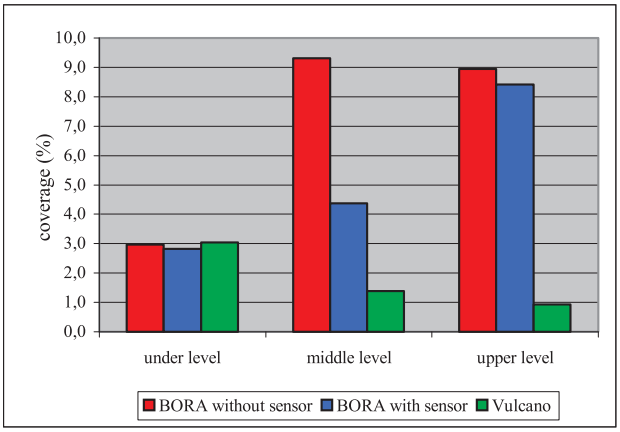

Figure 6. Coverage on the abaxial leaf surface

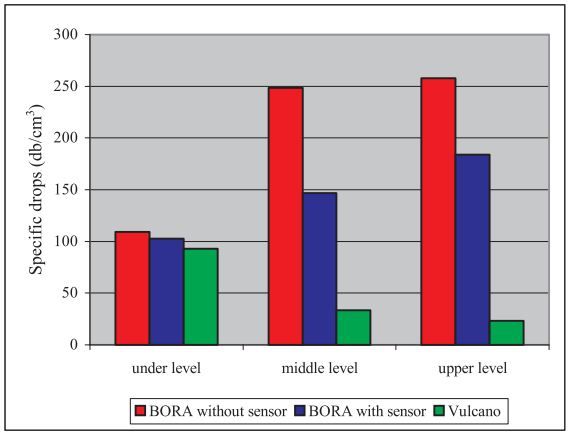

Figure 7. Specific drops on the abaxial leaf surface

The coverage ratios of about 1.00 colour-backside can be counted as excellent by the application of KERTITOX BORA machine without plant sensor, however, on the lower level of the

leafage it brought forth too coverage (Figure 6). On the basis of the examination results it can be established that the specific drop values (Figure 7) of the KERTITOX BORA machine during spraying significantly over-passed in every case the expected minimum 50-70 drops/cm^2 value of fungicide spraying.

The results of controlling obtainable spraying reduction

The examination results of pesticide carried out with KERTITOX BORA spraying machine with plant sensor switched on and off, under similar operation characteristics, can be seen in table 1.

Table 1. The examination results of pesticide reduction

Machine type	*Operation mode*	*Plantation*	*Specific liquid doses (dm^3/ha)*	*Savings (dm^3/ha)*	*Savings (%)*
KERTITOX BORA	Plant sensor switched off	2 years cherry	234	0	0
KERTITOX BORA	Plant sensor switched off	3 years cherry	175	0	0
KERTITOX BORA	Plant sensor switched on	2 years cherry	154	80	34,2
KERTITOX BORA	Plant sensor switched on	3 years cherry	132	43	24,6
VULCANO	Plant without plant sensor	3 years cherry	212	-	-

The results show that 34.2% was the pesticide saving with the application of plant sensor at practically smaller 2-year-old leafage plantation. The 24.6% saving at the 3-year-old plantation treatment can be considered significant as well. On the course of protection one-third of pesticide can be saved in younger fruit-gardens, while one-quarter results at the older ones.

Conclusions

On the basis of the comparison examination it can be established that of all the machines applied in the examination with similar parameters, modern and newly constructed sprayers ensured more favourable work quality values than the traditional spraying machines besides the given examination air circumstances and machine set-up parameters.

The standard deviation of work quality characteristics with such set-ups adjusting better to the given plantation characteristics can be reduced at each leaf crown level.

It can be clearly established from the examination results that without a significant change of the coverage characteristics meaningful liquid and pesticide savings can be obtained in loose lined young plantation as well.

References

1. Kalmár Imre (2004) „Influence of the plant protection technology on the deposit of the pesticide" IAMFE/RUSSIA Proceedings of 12th World Conference on Mechanization of Field Experiments, Saint-Petersburg, p 241-246

2. Kalmár Imre, Dimitrievits, György (2005) „Influence of the spraytechnik on the deposit of the spraydrops" Proceedings of the International Scientific Conference; Innovation and utility in the Visegrad Fours, Nyíregyháza, Volume p 529-534

3. Kalmár Imre Experiments with plant sensor on pesticide reduction in cherry plantation. Lecture, IAMFE (Denmark); June 30-July 3, 2008 Proceedings p 72-75

4. Kalmár Imre A műszaki-technikai megoldásokban rejlő növényvédő szer megtakarítási lehetőségek kísérleti igazolása. Debreceni Akadémiai Bizottság Műszaki Szakbizottsága, Debrecen 2009. p 135-142