JOURNAL OF PLANT PROTECTION RESEARCH
Vol. 41, No. 3 2001

SPRAYING OF WHEAT BY FIELD SPRAYER EQUIPPED WITH AN AIR SLEEVE AND DRIFT GUARD NOZZLES

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Accepted: June 11, 2001

Abstract: The quality of wheat spraying obtained while applying drift guard Turbo TeeJet 110 02 VP nozzles was tested. A standard boom and a boom equipped with an air sleeve were applied. Krukowiak-Bravo sprayer was used to test the influence of the air flux. The coverage was estimated on water sensitive papers. The spray coverage of wheat with TT 110 02 VP nozzles was satisfactory, both in case of conventional and air assisted applications.

Key words: spraying quality, coverage, air sleeve, drift guard nozzle

I. INTRODUCTION

Field sprayers can be equipped with standard booms with drift guard or injector nozzles to limit the drift of spray liquid to the neighbouring fields, during the chemical treatments (Wachowiak and Kierzek 1999, 2000). They can also be equipped with air sleeves to apply spray with air assistance. Drifting of spray liquid is initiated by swirling air following the moving sprayer and then is influenced by wind speed. An additional air flux is supposed to limit drift and to neutralize the influence of weather conditions. It also influences the quality of plant spraying. The option of a double protection against drift was applied in the tests since the drift reducing nozzles were fixed on a boom with air sleeve.

The research carried out recently shows that the spray volume may amount to 200 l/ha when spraying wheat with standard sprayers (Gajtkowski 2000).

It is assumed that wind speed, at the time of practice, will not exceed 3 m/s. The tests on application of lower spray volumes with drift reducing techniques are continuously being carried out. The treatments should be performed at agrotechnical periods suitable for a given pest or disease . That is why in vast area farms spraying practices are also carried out on days of stronger winds exceeding the speed of 3 m/s.

Therefore farmers more and more frequently purchase the sprayers equipped with air sleeves which show good performance even at the wind speed reaching 8 m/s.

The air volume can be adjusted but it is still uncertain whether a higher air volume changes the quality of leaf coverage.

The objective of the experiment was to evaluate the influence of air volume discharged by the air sleeve equipped sprayer on the spray coverage of the plant when applying low spray volumes.

II. MATERIALS AND METHODS

The Krukowiak-Bravo sprayer equipped with the air sleeve with air volume adjusted within range 0–20 000 m^3/h (air positions 0–6) was used during the tests. No air application (air position 0) and two air volumes (air position 1 is 4 000 m^3/h and air position 3 is 10 000 m^3/h) were used in the tests. The maximum air unit output in position 6 is 20 000 m^3/h. Boom width measured 12 m and angle of air was 15° backwards. Turbo TeeJet TT 110 02 VP nozzles were used and the pressure of the sprayed liquid was: 0.15, 0.3 and 0.5 MPa. The liquid was pure water at the temperature of 14°C.

Table 1

Working parameters of sprayer Krukowiak-Bravo

Spray tip	Liquid pressure p (MPa)	Flow rate q (l/min)	Speed V_p (km/h)	Spray volume Q (l/ha)
TT 110 02 VP	0.15 0.30 0.50	0.56 0.79 1.04	6.9 6.9 6.9	97 137 177

The working parameters of the air sleeve equipped Krukowiak – Brawo sprayer are shown in table. The working liquid pressure values (p) were changed which resulted in changes of flow rates of TT 110 02 VP nozzles which were 0.56; 0.79 and 1.04 l/min. Relatively low spray volumes 97, 137 and 177 l/ha were obtained at constant working width of 12 m and constant working speed of 6.9 km/h.

The temperature of the air during the tests was about 20°C, the relative air humidity about 70% and the wind speed oscillated within 3.0–4.5 m/s.

Water sensitive papers were used as spray collectors to measure spray coverage. The collectors were placed on leaves at three levels: I – plant tops, II – half the height and III – ground surface. The papers were placed in three groups of 6 at each level. The height of the plants reached 50 cm while their number was 650 plants per m^2.

Coverage was described by help of a set used for the analysis of an image; the set consisted of Panasonic Color CCTV camera and computer. A special programme for the analysis of the image was installed in the computer. Error did not exceed 2%.

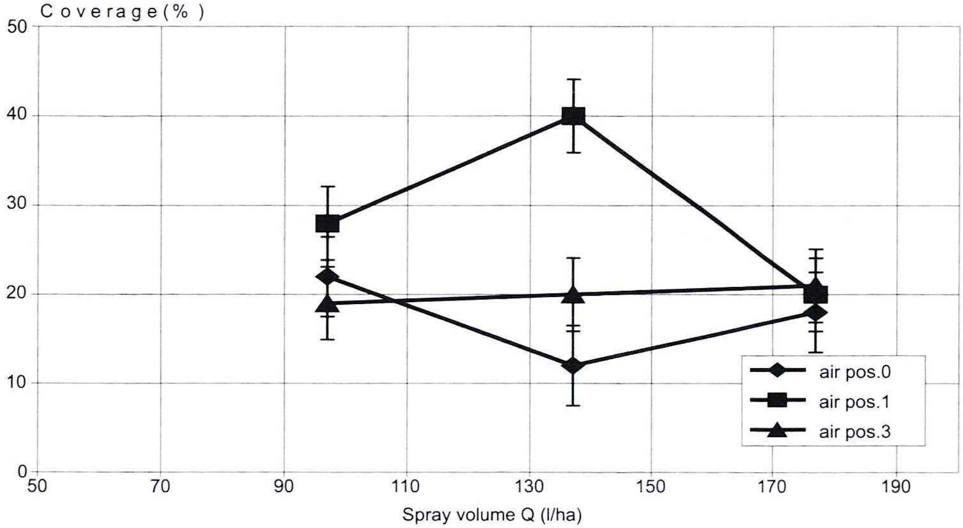

Fig. 1. Spray coverage at plant tops (level I) for different air settings and spray volumes

III. RESULTS

The spray coverage for three spray volumes applied without and with air assistance is presented in Fig. 1. The highest coverage of the tops reaching 40% was obtained when applying the spray volume 137 l/ha and at lower air volume (air position 1). A sufficient coverage between 10 and 20%, was obtained for all three spray volumes at no air and higher air volume situations. There are no significant differences in coverage between those two

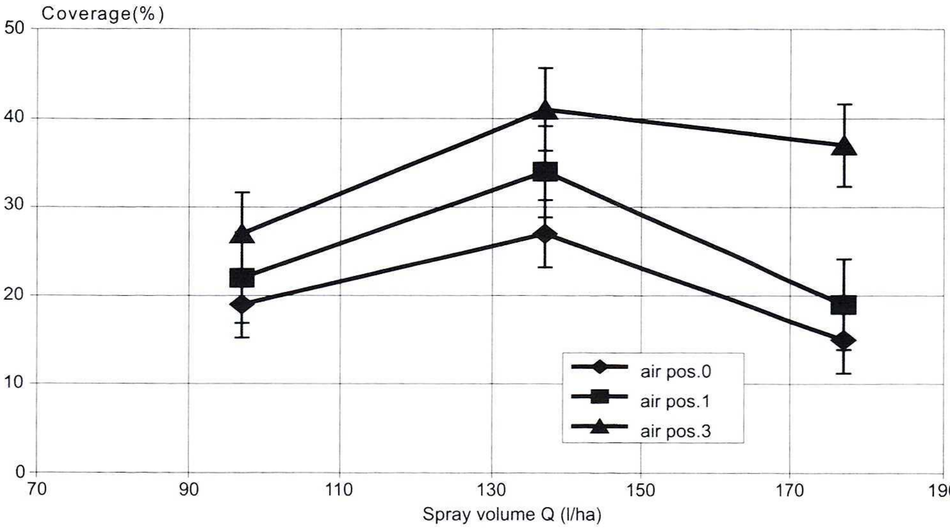

Fig. 2. Spray coverage at plant half-height (level II) for different air settings and spray volumes

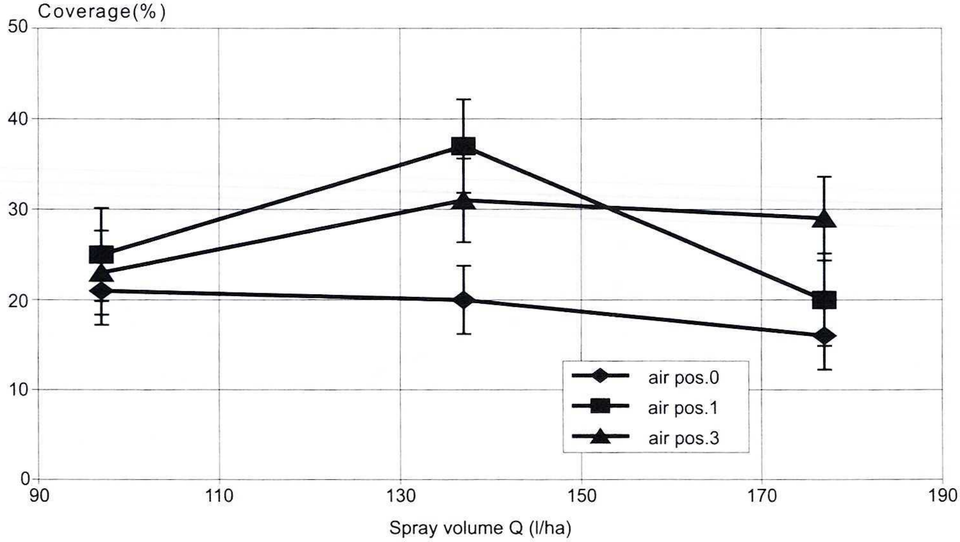

Fig. 3. Mean spray coverage at whole plant for different air settings and spray volumes

sprayer settings. Student's multiple range test t at the level of significance of $\alpha = 0.05$ was used for statistical evaluations. The successive values of coverage are described by help of the range of confidence interval.

The coverage of wheat at its half-height level, depending on spray volume and air setting was presented in Fig. 2. The highest coverage (about 40%) was obtained for higher air setting (air position 3) for spray volumes 137 and 177 l/ha. The increase of spray volume from 137 to 177 l/ha for no air and low air situations significantly decreased the coverage of

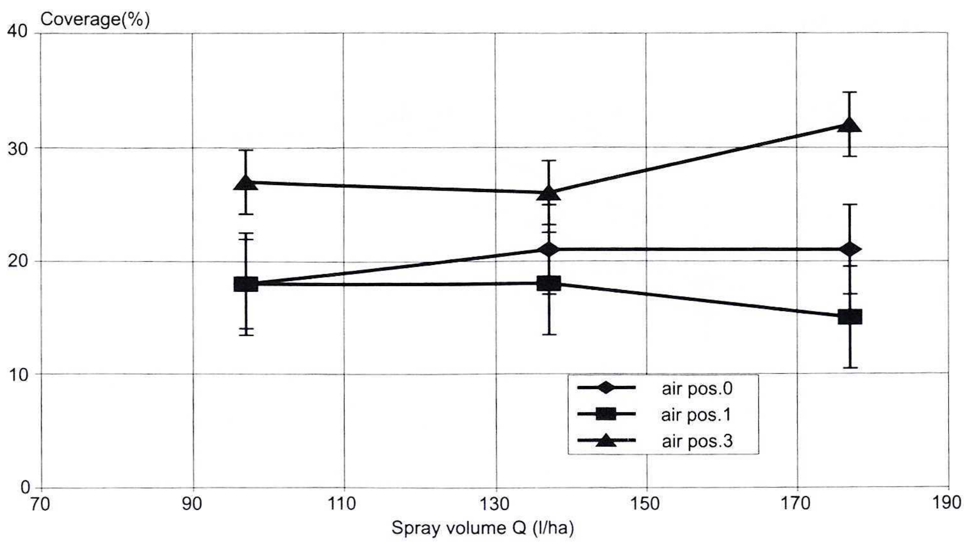

Fig. 4. Spray coverage on the ground for different air settings and spray volumes

wheat leaves. The quality of plant spraying at their half-height for those two situations did not differ significantly within the whole range of the applied spray volume.

Mean values of coverage on the whole plant were calculated and presented in Fig. 3. The value of wheat coverage was sufficient in the whole range of the spray volume and at the air settings. The coverage was improved when using air assistance. It was highest for spray volume of 137 l/ha. An unexpected decrease of coverage for the spray volume 177 l/ha was observed. The highest values of mean coverage of the surface of the leaves of the whole plant amounting from 30 to 37% were obtained when spray volume 137 l/ha was applied with air assistance.

Loss of the liquid i.e. the amount of liquid that does not stay on the plant, is of interest during the investigations on the quality of plant spraying. The coverage recorded on water sensitive papers placed on the ground under the sprayed leaves, was also evaluated and the results were presented in Fig. 4. The ground was covered by the liquid to the highest degree during the spray application of higher air volume (air position 3) within the full range of spray volumes. The highest coverage, equalling 32%, was observed when using 177 l/ha. Lower spray loss of 18–27% occurred in the whole range of the applied spray volume but it was noticed that ground coverage for low air setting and no air did not differ significantly.

IV. CONCLUSIONS

The spray coverage of wheat with guard drift Turbo Teejet 110 02 VP nozzles was satisfactory, both in case of conventional and air assisted applications.

The influence of air assistance on the spray coverage both at the top and half-height of plant was varied. It should be stressed though that the air assistance improved the spray coverage. The low air volume should be applied in order to avoid high loss of the liquid falling down to the ground.

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OPRYSKIWANIE PSZENICY OPRYSKIWACZEM WYPOSAŻONYM W RĘKAW POWIETRZNY I ROZPYLACZE ANTYZNOSZENIOWE

STRESZCZENIE

W celu zmniejszenia znoszenia cieczy w czasie opryskiwania roślin na sąsiednie pola, opryskiwacze polowe mogą być wyposażone w belki opryskujące standardowe z rozpylaczami antyznoszeniowymi lub eżektorowymi. Mogą też być wyposażone w belki z rękawami powietrznymi. Dodatkowy strumień powietrza ma również wpływ na jakość opryskiwania roślin.

W badaniach zastosowano wariant podwójnego zabezpieczenia przed znoszeniem, czyli oprócz rękawa powietrznego na belce opryskującej zamontowano rozpylacze antyznoszeniowe. Do opryskiwania wykorzystano opryskiwacz Krukowiak-Bravo i rozpylacze Turbo TeeJet TT 110 02 VP.

Jakość pokrycia powierzchni liści opryskiwanej pszenicy jest zadowalająca zarówno przy stosowaniu badanych rozpylaczy bez dodatkowego strumienia powietrza, jak i z dodatkowym strumieniem. Wpływ wydatku strumienia powietrza na jakość pokrycia wierzchołków roślin i liści w połowie wysokości roślin był zróżnicowany. Dodatkowy strumień powietrza z rękawa poprawiał jakość opryskiwania. Najlepiej jest to widoczne przy stosowaniu dawki 137 l/ha. Stopień pokrycia powierzchni dla tej dawki oraz małego i średniego wydatku powietrza (poz. 1 i 3) uzyskuje się w granicach 30–37%. Ze względu na dość duże straty cieczy opadającej na glebę, należałoby stosować dodatkowy strumień powietrza o małym wydatku.