Design and Development of an Automatic Spray Depositions Collecting and Analysing Machine

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Introduction

Agricultural pesticides, insecticides, fungicides and herbicides are used in great quantity to protect crops from damage by insects and fungi and to reduce competition from weeds. Pesticides application in the agricultural sector has increased from negligible amounts in the pre-World War 2 era to over 1 billion kilograms per year. Despite the use of these pesticides, crop losses were estimated at about 30 percent in the United States. This translates to an economic loss of $16 billion per year (Wolff et al., 1989).

Most of these chemicals were applied as sprays using agricultural sprayers. Many studies have confirmed the misapplication of these agricultural sprays in the field. Couch reported that individual application errors of 25 to 35 percent in the United States (Couch, 1988). Ozkan found that thousands of liters were wasted annually because of improperly calibrated sprayers (Ozkan, 1987). Over-application of pesticides increases production costs, potential crop damage, pollution and excessive residue carryover (Grisso et al., 1988). Under application of pesticides can be costly because the chemical may not effectively control the target pest. Under application may also lead to an additional application that may not be timely to protect the crop and may cause reduction in crop yield (Hoehne and Brumet, 1982). Poor performance of sprayers can be caused by many factors such as blocked spray nozzles; extremely high or low spray pressure, incorrect settings of the air blast and nuzzling of the sprayer. Once the spray deposition pattern for a particular sprayer and a particular type of trees has been determined, sprayer adjustments and replacements can be made to improve the deposition pattern. A tool or a machine to quickly measure spray deposition pattern throughout the plant canopy is needed which will assess the sprayer performance in the field.

Materials and Method

Cotton String was laid in the plant canopy to collect spray depositions. String dispenser was used to quickly dispense cotton string. String Reminder was used to retrieve sprayed string. String supporter was used to keep string in desired position. Rhodamine WT was used as fluorescent dye mixed in water and used as spray solution. Fluorometer was used to analyse intensity of fluorescent dye. Tractor and air blast sprayer for field appli-cation of spray solution. Computer for input output feeding and analysing. Printer/Plotter for producing hardcopies of results and recommen-dations. Tree canopies under spray deposition studies.

Results and Discussion

The use of cotton string as an artificial spray collector was found to be possible. String supporters for holding cotton string in the field were fabricated and used. String movement was smooth throughout the Supporters. Portable electric was modified and found to retrieve cotton string throughout the string supporter within plant canopy. String dispenser was fabricated and found to freely dispense the string and protect unused portion from contamination. Fluorometer reading ability using the available Fluorescent dye was not satisfactory but movement of the sprayed string within the fluorometer was smooth. Computer program for quick reading, analysing and recommending of potential actions were yet to be developed.

Conclusions

This research project has opened up another opportunity and possibility of developing a machine, which can quickly and easily measure the performance of agricultural sprayers. Users of agricultural sprayers can almost be sure that right amount of agricultural spray solution reached the target with the desired spray patterns. Major problems with the sprayers are discovered and remedial actions taken to perfect the sprayer performance. This machine helped in ensuring that real toxic chemicals are applied using sprayers, which are able to produce spray droplets of desired sizes, amount, uniformity and pattern.

Benefits from the study

This study can be regarded as a foundation study for future work to be done in relation to spray droplets monitoring. A more efficient sprayer performance can be produced which will avoid under or over spraying. This study will help in precise application of spray solution, which will benefit spray operators, crop owners, and consumers of the crops.

Project Publications in Refereed Journals

Akesson, N.B., Bayer, D.E. and Yates, W.E. 1989. Application effects of vegetable oil additives and carriers on agricultural sprayers. *Adjuvants and Agrochemicals*, vol. II, CRC Press, Inc. Boca Raton, Fla.

Azimi, A.H., Capenter, T.G. and Reichard, D.L. 1985. Nozzle spray distribution for broadcast pesticide application. Transaction of the ASAE.

Barry, J.W., Ekblad, R.B., Markin, G.P. and. Irostle, G.C. 1978. Methods of sampling and assessing deposits of insectidal sprays released over forests. *USDA Technical Bulletin.*

Couch, H.B., 1988. Maximizing the effectiveness of fungicides. Milliken and Company.

Wolff, R.L et al. 1989. Field results of air assisted spraying drift and dessication. Transaction of the ASAE.

Project Publications in Conference Proceedings

None.

Graduate Research

None.

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