UNIVERSITI PUTRA MALAYSIA

EFFECT OF SURFACTANTS ON THE RAINFASTNESS OF GLYPHOSATE ON *Clidemia hirta*

NURSHAHIRA MOHD HALIM

FP 2016 46

EFFECT OF SURFACTANTS ON THE RAINFASTNESS OF GLYPHOSATE ON *Clidemia hirta*

NURSHAHIRA BINTI MOHD HALIM

DEPARTMENT OF PLANT PROTECTION

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR DARUL EHSAN

2015/2016

EFFECT OF SURFACTANTS ON THE RAINFASTNESS OF GLYPHOSATE ON *Clidemia hirta*

BY

NURSHAHIRA BINTI MOHD HALIM

A project report submitted to Faculty of Agriculture,Universiti Putra Malaysia,in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science

Faculty of Agriculture

Universiti Putra Malaysia

2015/2016

This project report entitled Effect of Surfactants on the Rainfastness of Glyphosate on *Clidemia hirta* is prepared by Nurshahira Binti Mohd Halim and submitted to Faculty of Agriculture,Universiti Putra Malaysia,in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science.

Student's name: **Student's signature:**

Nurshahira Binti Mohd Halim ……..

Certified by:

……

(Supervisor's signature and official stamp)

Prof. Dr. Dzolkhifli Omar

Project supervisor,

Department of Crop Protection,

Faculty of Agriculture Science

Universiti Putra Malaysia

Date:…….

ACKNOWLEDGEMENTS

I would like to express a sincere thankfulness and appreciation to my supervisors Prof Dr. Dzolkhifli Bin Omar for his supervision of my academic program and support towards the completion of this thesis.My appreciation and honest thanks to Dr.Norhayu Asib,PhD student and Mr. Yasir,Master student of Prof Dr. Dzolkhifli Bin Omar for their assistance in statistical analysis.

A lot of appreciation and thanks to all staff members from Department of Crop Protection especially Mr. Zaki Yusof and Mr. Jakasi Sarbini for their kind assistance and help during my studies.I would like to acknowledge to all friends Izat Eztte Binti Musa,Nur Shamsinar Binti Tajudin,NurFatin Binti Ruslan,Nurul Athirah Binti Jupery and Normala Binti Adam for their cooperation and support to complete the thesis.

Finally,a special appreciation and gratitude to my beloved parents Mohd Halim Bin Surip and Salmah Binti Ahmad and my siblings Mohd Haikal Mohd Halim,Nurshazelin Mohd Halim and Nurshaliza Mohd Halim for their encouragement,moral and financial support during my studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF ABBREVATIONS

ANOVA	=	Analysis of variance
LV	=	Low volume
VLV	=	Very low volume
ULV(CDA)	=	Ultra low volume
CF	=	Constant flow
NaOH	=	Sodium hydroxide

LIST OF UNIT

UNIT:

mN/m	=	Milinewton/meter
wt	=	Weight
w/w	=	Weight/weight
cm	=	Centimeter
L/ha	=	Liter per hectare
%	=	Percentage
mm/h	=	Milimeter per hour
mm	=	Milimeter
m	=	Meter
litre/min	=	Litre per minute
m/min	=	Meter per minute
M	=	Molar
g	=	Gram
ppm	=	Part per million

ABSTRACT

Clidemia hirta, a perennial shrub weed from the family of Melastomaceae can be found in many tropical regions of the world. The weed is distinct among many invasive plant species of the Malaysian because of its ability to invade anthropogenically undisturbed primary and tall secondary forests. In Malaysia, it is major pest on the oil palm and rubber plantation.Glyphosate is one of the broad-spectrum systemic herbicide that can be used to control this weed. Surfactant is often mixed with glyphosate to enhance the activity of glyphosate, improve wetting of the surface of plants for maximum coverage and aid penetration through the plant surface. However, rain shortly after herbicide application is one of the most detrimental issues for herbicide performance. The research was conducted to determine the influence of surfactants on the rainfastness of glyphosate on C.*hirta.* The experiment was conducted at Field 2, UPM Serdang. Glyphosate at 3 L product/ha and spray volume of 450L/ha was used together with the surfactants at recommended concentration of 0.024% for Silwet 408, 0.05% for Miracle S240, 0.1% for Kao A-134 and 0.14% BOND Adjuvant. Spraying was conducted on eight week old plants after transplanting followed by exposure to the rainfall using rainfall stimulator at 1 and 3 hours after spraying. The evaluation parameters were spray deposition, necrosis and chlorophyll content. The result was analyzed by using ANOVA and mean separation by Tukey. All treatments of glyphosate with surfactant showed better performance in killing the weeds compared with glyphosate alone. Treatment of glyphosate with Miracle S240 showed lower mean chlorophyll content and higher necrosis and spray deposition.The rain at 3 hours after spraying showed the higher spray deposition compared to 1 hour.More spray deposition was washed

out at 1 hour after spraying. Miracle S240 was one of the best surfactant that improved the rainfastness of the herbicides.

ABSTRAK

Clidemia hirta merupakan tumbuhan rumpai parenial daripada keluarga Melastomacea yang banyak dijumpai di kawasan tropika di dunia.Rumpai ini adalah berbezaantara banyakspesies tumbuhaninvasifdi Semenanjung Tanah Melayukerana rumpai ini berkeupayaannya untuk menyerang anthropogenically hutan sekunder rendah dan tinggi.Di Malaysia,rumpai ini merupakan perosak utama dalam perladangan kelapa sawit dan getah.Glifosat merupakan salah satu racun herba berspektrum luas dengan aktiviti sistemik yang boleh digunakan untuk mngawal rumpai ini.Surfaktan selalunya akan dicmpur dengan glifosat untuk meningkatkan keberkesanan glifosat,memperbaiki pembasahan pernukaan pokok dengan liputan yang lebih meluas dan membantu menembusi permukaan pokok.Akan tetapi,hujan selepas penyemburan adalah merupakan salah satu masalah yang kritikal kepada kebolehan racun tersebut.Satu kajian telah dibuat di Ladang 2 ,UPM Serdang.Glifosat dengan 3 L produk/ha dan 450 L/ha isipadu semburan digunakan bersama surfaktan 0.024% untuk Silwet 408 ,0.05% untuk Miracle S240, 0.1% untuk Kao A-134 and 0.14% untuk BOND Adjuvant mengikut kadar konsentrasi yang disyorkan.Penyemburan dilakukan pada minggu ke lapan selepas penanaman semula anak pokok dan di ikuti dengan hujan sejam dan tiga jam selepas penyemburan dengan mnggunakan hujan simulasi.Parameter penilaian adalah pemendapan semburan,nekrosis dan kandungan klorofil.Data telah dianalisa menggunakan ANOVA dan pengasingan min dengan menggunakan TUKEY.Kebarangkalian adalah $P<0.05$.Kesemua rawatan daripada glifosat dengan surfaktan menunjukkan keberkesanan yang lebih baik bagi membunuh rumpai tersebut jika dibandingkan dengan hanya menggunakan glifosat sahaja.Kajian antara glifosat dan Miracle S240 menunjukkan bacaan kandungan klorofil yang paling rendah dan bacaan nekrosis

dan mendapan semburan yang tinggi.Hujan selepas 3 jam semburan menunjukkan nilai bacaan mendapan semburan ynag lebih tinggi dibandingkan dengan hujan selepas 1 jam semburan.Banyak mendapapan semburan telah mengalir keluar pada 1 jam semburan.Miracle S240 merupakan salah satu surfaktan yang paling berkesan dalam memperbaiki masalah hujan kepada racun rumpai.

CHAPTER 1

INTRODUCTION

1.1 Background

Weeds have been documented as a serious plant pest since the ancient times (Zimdahl, 2013) and major pest in oil palm production system (Rosli *et* al., 2010). They compete with the crop plants for available nutrients, space, light, and moisture (Khawar *et* al.,2015) to cause a considerable loss in their productivity. This can be proven when the weeds can lower the crop productivity by an average about 34% (Oerke, 2006). Weeds can be suppressed or eradicate through weed control. The most reliable weed control methods include herbicide application.

Herbicides, commonly known as weedkillers, are used to kill unwanted plants that cause disturbance to the crop especially agriculture crop. Herbicides can be grouped through their activities which either contact herbicide and systemic herbicide.Contact herbicides are the fast acting herbicides in which these herbicides destroy only the plant tissue in contact with the chemical.They are less effective on perennial plants because the rhizomes,roots or tuber of the perennial plants are able to regrow.On the other hand,systemic herbicides are herbicides that can be translocated through the plant system either from foliar application down to roots or from soil application up to the leaves.These herbicides are capable of controlling perennial plants and slow-acting, but ultimately more effective than contact herbicides.

Moreover, application of herbicides on plants can be more effective by adding of adjuvants. Adjuvants play important roles as sticking, wetting,

spreading, foaming, reducing foam, dispersing, reducing spray drift, and also enhancing biological activity. Common examples of adjuvants are surfactant (Stickle, 1992). It is well known that the proper use of adjuvants with certain herbicides often can improve the biological activity of the active ingredient (a.i.), the performance of the spray application and the economics of herbicide applications (Underwood, 2000). However, the sustainability of long term chemical weed control is facing certain challenges (Khawar *et* al. 2015).

Considering environmental factors, rain shortly after herbicide application is one of the most detrimental issues for herbicide performance. Adjuvants have been shown to improve the rainfastness of herbicides and the effect on rainfastness should be considered when selecting an adjuvant (Kudsk *et al*. 1989).

Therefore, this study was to determine the effect of surfactants on the performance of glyphosate and to evaluate the effect of rainfall on the efficacy of glyphosate with different surfactants on *Clidemia hirta*, the perenial weed of rubber and oil palm plantation.

1.2 Problems statement

Adjuvants or surfactants in the proper used with certain herbicides often can improve the biological activity of the active ingredients,the performance of the spray application and also the economics of the herbicide application (Underwood 2000). But rain shortly after herbicide application is one of the most detrimental issues for herbicide performance.Thus ,adjuvants or surfactants have been shown to improve the rainfastness of herbicides and the effect on rainfastness should be considered when selecting an adjuvant or surfactant (Kudsk *et* al. 1989).

1.3 Objectives

The objective of this study is to determine the influence of surfactants on the rainfastness of glyphosate on C.*hirta.*

1.4 Hypothesis

H_0 : Surfactants do not improve the rainfastness of glyphosate on *C.hirta*.

H_A : Surfactants improve the rainfastness of glyphosate on *C.hirta*.

REFERENCES

Anderson, R.G. 2004.Effect of sucrose solution on post-harvest life of Godetia*(Clarkia amoena)*.*Floriculture Research Report* 14(4):1-7

Anonymous. 1954.Notes and exhibitions.Prooceedings of the Hawaiian Entomological Society 15:263-265

Binggeli P, 2003. Introduced and invasive plants In: Goodman SM, Benstead JP, eds. The Natural History of Madagascar. Chicago, USA: University of Chicago Press, 257-268.

DeWalt, S. J. (2003). The Invasive Tropical Shrub *ClidemiaHirta* (Melastomataceae) in its Native and Introduced Ranges: Tests of Hypotheses of Invasion. PhD Thesis,Louisiana State University . Pp130.

De Walt, S.J., Denslow,J.S. and Ickes, K. (2004).Natural-enemy release facilitates habitat expansion of the invasive tropical shrub *Clidemiahirta.Ecology*, **85**, 471-483.

Dos Santos J.B., Ferreira E.A., Kasuya M.C.M., Da Silva A.A. *and* De Oliveira Procópio S.2005.Tolerance of *Bradyrhizobium* strains to glyphosate formulations. *Ind. Crops Prod*.24, 543–547.

G-Planter,2015.Miracle S240. Retrieved on 14th April 2015 from www.g-planter.com.Pp1-2

Harker K.N.1992.Effects of various adjuvants on sethoxidim activity.*Weed Technol*.6:865–870.

J.M Green, J.H Green (1993).Surfactant structure and concentration strongly affect rimsulfuronactivity.Weed Technology, 7 : 633–640

Kudsk, P., &Kristensen, J. (1992).Effect of environmental factors on herbicide performance.*Proceedings of the First International Weed Control Congress,* 17-21.

Mohamad, R., Wibawa, W., Mohayidin, M. G., Puteh, A., Juraimi, A. S., Awang, Y., &MohdLassim, M. (2010). Management of mixed weeds in young oil-palm plantation with selected broad-spectrum herbicides.*Pertanika Journal of Tropical Agricultural Science, 33*(2) : 193-203.

Monaco, T.J., Weller, S.C., Ashton, F.M., 2002. Weed Science. Principles and Practices, 4th Edition. Wiley, New York, pp. 146–156.

Mune, T., & Parham, J. W. (1967). The declared noxious weeds of fiji and their control.*Bull.Dep.Agric.Fiji, 48*

Ngah, N. (2010). Effects of Leaf Surface Characteristics and Spray Droplets on Effectiveness of Selected Glyphosate Formulations, Master Thesis,university Putra Malaysia.Pp 94

Oerke, E. (2006). Crop losses to pests. *The Journal of Agricultural Science, 144*(01) : 31-43.

Teoh, C., Toh, P., Khairudin, H., Heong, K., Lee, B., Lim, T., & Ibrahim, Y. (1982). Chemical control of asystasiaintrusa (bl), clidemiahirta (don.) and elettariopsiscurtisii (bak.) in rubber and oil palm plantations. In *Proceedings of the International Conference on Plant Protection in the Tropics.*497-510.

Pannacci, E., Mathiassen, S. K., &Kudsk, P. (2010).Effect of adjuvants on the rainfastness and performance of tribenuron-methyl on broad-leaved weeds. *Weed Biology and Management, 10*(2):126-131.

Reddy, K. N., & Singh, M. (1992).Organosilicone adjuvant effects on glyphosate efficacy and rainfastness. *Weed Technology,* 361-365.

Rubber Research Institute of Malaya.(1973).*Clidemiahirta* n South Johore.*Planter's Bulletin*, **128**: 140-144.

Sharma, S., & Singh, M. (2000).Optimizing flare activity of glyphosate on *Bidensfrondosa* and *Panicum maximum* with different adjuvant types. *Weed Research, 40*(6):523-533.

Simmonds,H.W. (1933).Biological control of the need *Clidemiahirta.Bulletin of Entomological Research* , **24**:345-348.

Smith, C. W. (1992). Distribution, status, phenology, rate of spread, and management of clidemia in hawaii. *Alien Plant Invasions in Native Ecosystems of Hawaii.University of Hawaii Press, Honolulu,* 241-253.

Smith, C.W.(1992). Disribution,status,phenology,rate of spread and management of Clidemia in Hawai. In *Alien Plant Invasions in Native Ecosystem of Hawaii*,*Management and Research*, ed. C. P.Stone,C.W. Smith and J. T. Tunison.Honolulu,HI: Cooperative National Park Resources Studies Unit,Universiti of Hawaii, pp. 241-253

Underwood A.L.2000.Adjuvant trends for the new millennium. *Weed Technol*.14:765–772.

Wester LL, Wood HB, 1977. Koster's curse *(Clidemiahirta),* a weed pest in Hawaiian forests. *Environmental Conservation*, 4(1):35-42

Vanhaecke M. 2000. Agrochemical adjuvant: mode of action and benefits. Planters 76:123–136.

Zabalza, A., González, E. M., Arrese-Igor, C., &Royuela, M. (2005). Fermentative metabolism is induced by inhibiting different enzymes of the branched-chain amino acid biosynthesis pathway in pea plants. *Journal of Agricultural and Food Chemistry, 53*(19): 7486-7493.

Zimdahl, R. L. (2013). *Fundamentals of weed science* Academic Press.