Journal of Agricultural Chemistry and Environment, 2023, 12, 134-141
https://www.scirp.org/journal/jacen
ISSN Online: 2325-744X
ISSN Print: 2325-7458

Evaluation of Protector 700 Wd in Controlling Tobacco Pests in Tanzania

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How to cite this paper: Dunda, D.R., Ntatilwa, M.R., Muna, E.I. and Zawadi, E.A. (2023) Evaluation of Protector 700 Wd in Controlling Tobacco Pests in Tanzania. *Journal of Agricultural Chemistry and Environment*, **12**, 134-141.
https://doi.org/10.4236/jacen.2023.122011

Received: February 7, 2023
Accepted: May 9, 2023
Published: May 12, 2023

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Abstract

In Tanzania, tobacco is an important cash crop benefiting most farmers and stakeholders. However, the crop is characterized by a low yield per unit area. Several factors are responsible for the low yield and quality of tobacco, among which are damages caused by the insects and other pests. Major insect pests of tobacco are cutworms (*Agrotis spp*), budworms (*Heliothis virescens* (F.)), (*Lepidoptera Noctuidae*) and aphids (*Myzus persicae*, *Aphis tabaci*) (*Homoptera*: *Aphididae*). These pests adversely affect crop growth, yield and leaf quality. In order to reduce insect attack in tobacco, applying pesticides is a critical management practices. In Tanzania, various pesticides have been approved for use in controlling the pests. Currently, farmers are using Bamethrine 2.5 EC to control the pests. The Pesticide named Protector 700 WG with an active ingredient imidacloprid 700 g/kg is a new product introduced in Tanzania during the 2021/22 crop season. Research trials were conducted in three research sites, namely Ulowa-Kahama, Tumbi-Tabora and Mtanila-Chunya, on Protector 700 WG efficacy in different rates, 15 g, 20 g, and 25 g each dissolved in 20 litres of water. The Protector 700 Wg was compared with the standard pesticide (Bamethrin 2.5 EC). Absolute control was also inclusive where the plot had no application of pesticides. The results showed that Protector 700 WG at all rates outweigh the commonly used pesticide. The difference in the number of pests between Protector 700 WG and Bamethrin 2.5 EC was significantly at $P < 0.005$ also, in dry and green weights, the yield was significantly different at $P < 0.005$. However, when yield and number of insects were compared among the rates of protector, there was no significant difference. From these results, farmers are advised applying Protector 700 WG at the rate of 0.15 kg/ha by dissolving it in 200 litres of water.

Keywords

Tobacco, Insect, Protector

1. Introduction

Tobacco cultivation plays an important and positive role in livelihoods by improving the well-being and increasing the resilience of tobacco farmers and labourers (BAT, 2017). In Tanzania, tobacco is one of the major cash crops benefiting most farmers and other stakeholders [1]. However, tobacco farming is dominated by smallholder farmers operating under high risk of varying environmental conditions. As a result, the production is characterized by low yield per unit area, low capital return, low farm inputs and intensive farming [2].

According to TTB (2019), the tobacco yield per hectare is 1650 kg/ha, while the potential yield ranges from 2000 to 2400 kg/ha (TORITA, 2019). Several factors are responsible for the low yield and low quality of tobacco, among which damages caused by the insect pest are a severe constraint [3]. Major insect pests of tobacco are cutworms (*Agrotis ipsilon*, *A. segetum*, *A. flammatra*), budworms (*Heliothis virescens* (*F.*)) (*Lepidoptera*: *Noctuidae*) and aphids (*Myzus persicae and Aphis tabaci*) (Homoptera: Aphididae) [4]. These pests adversely affect the crop growth, yield and leaf quality [5].

Due to this, tobacco production is a heavily pesticide-dependent crop. Different pesticides have been tested and approved to control pests in tobacco. According to US Environmental (2007), pesticides are substances used primarily for pest control that can occur in both animals and plants.

Before the pesticide is registered for tobacco use, a test must be performed to evaluate its performance. Applying suitable pesticides at the correct dosage gives better results [6]. Pesticide evaluation is done in three growing seasons or three agroecological zones to evaluate its performance in various climatic conditions.

Protector 700 Wg is a systemic, chloro-nicotinyl insecticide with soil, seed and nervous system. Specifically, it causes a blockage in a type of neutral pathway. This blockage leads to the accumulation of acetylcholine, an important neurotransmitter, resulting in the insect's paralysis and eventually death.

Protector 700 Wg was brought to TORITA by Export Trading Group (ETG) during the crop season 2021/22 to test its performance in tobacco pests control. Protector 700 WG with the active ingredient Imidacloprid was evaluated in tobacco crop in three agroecological zones (Ulowa-Kahama, Mtanila-Chunya and Tumbi-Tabora) to test its efficiency in controlling the pests.

2. General Objective

The overall objective was to evaluate the effectiveness of Protector (imidacloprid 700 g/kg) for controlling pests such as aphids and white flies.

Specific Objectives

- To determine the effective rate of Protector (700 g/kg) in tobacco pests control.
- To obtain important agronomic information such as application rate and usage of Protector (700 g/kg) for its registration and use in tobacco crop in

the country

3. Materials and Methods

3.1. Study Area

The trial was conducted in three sites namely, Mtanila-Chunya, Tumbi-Tabora and Ulowa-Kahama.

3.1.1. Mtanila-Chunya

Mtanila is one of the villages found in Chunya District. The District is found in Mbeya Region. Mtanila is located at latitude 7.95 South, longitude 33.34 East and altitude of 1378 m a.s.l with an average rainfall of 750 mm. According to the region social economic profile the major economic activities in the area is agriculture where by crop cultivation and animal husbandry are practiced. Crops which are crown include tobacco, maize, beans, millet, cassava, potatoes, sorghum, groundnuts, and paddy. Animal husbandry includes cow, goat and bees.

3.1.2. Tumbi-Tabora

Tumbi is one of the villages found in Tumbi ward in Tabora Municipal, Tabora region. Tumbi is situated along the Urambo road about 16 km from Tabora town. The place is located at latitude 5.11 South, longitude 32.68 East and altitude of 1151 m a.s.l. Agriculture is the main economic activity, focusing on maize, rice, groundnuts, beans, cowpeas, cassava, sweet potatoes and tobacco. Livestock farming is also an important economic activity in the area. Tumbi receive an average rainfall of about 950 mm.

3.1.3. Ulowa-Kahama

Ulowa is one of the villages found in Kahama District in Shinyanga Region. The village is found at the latitude 4.2 South, longitude 32.15 East, altitude of 1156 m a.s.l. Ulowa receive the rainfall of about 990 mm. The major economic activitiy is agriculture where by crops grown is maize, groundnuts sweet potatoes at tobacco as cash crop.

3.2. Design

In all the three sites Tumbi-Tabora, Ulowa-Kahama and Mtanila-Chunya, the tobacco variety named K326 was sowed in seedbeds. The seedbed size was 20 m long and 1.5 m width. Seedlings were raised in seedbed for about 60 days. All seedbed management practised was practised. When seedlings were matured, transplanting was done.

At tumbi transplanting was done on 07/12/2021, Mtanila-Chunya transplanting was done on 27/12/2021, and at Ulowa-Kahama, transplanting was done on 15/12/2021. The topping was done accordingly to prevent flowering. Suckers were controlled by Yamaotea super 305 EC. Fertilizer basal application NPK 10:18:24 was applied seven days after transplanting at the rate of 30 g/plant, while CAN27%N was top dressed 21 days after transplanting at the rate of 8 g/plant. Other routine field management was done according to Good Agricul-

tural Practices (GAP). Insects were counted before pesticide application, two weeks after pesticide application and four weeks after pesticides application.

The trial was laid out in a Completely Randomized Block Design with three replications and four treatments. The plot size was 6 m by 6 m, making a total of 36 m^2. Spacing used was 1.2 m ridge to ridge and 0.5 m plant to plant. Each plot comprised of 66 plants.

3.3. Treatments

The following treatments were applied per plot:

1) 15 g Protector 700 WG per 20 litres of water.
2) 20 g Protector 700 WG per 20 litres of water.
3) 25 g Protector 700 WG per 20 litres of water.
4) 0.08 l/ha Bamethrin 2.5 EC (Standard Pesticides) per 20 litres of water.
5) Absolute control.

3.4. Data Collection

Data collected from all three sites included the number of insects before pesticides application, two weeks and four weeks after pesticides application. Other data collected were green leaf weight, dry leaf weight and the grade index was computed. On average, all sites had seven reapings, and at each reaping, two leaves per plant were harvested, making a total of 120 weighed green leaves for each plot, and were tied to sticks and taken to barn for curing. After curing, dry leaves were weighed.

3.5. Data Analysis

Data analysis was done using the Genstat 8th Edition version. Statistical analysis from all the three experimental sites (Chunya, Tabora, Kahama) was done using Genstat 8th Edition and ANOVA. The significant means were compared using Duncan at P = 0.05. This was done inorder to find if the results obtained from each collected date is significant at P = 0.05. The significant results tell that there is an effect or relationship between the variables being studied in the research. For the insect count before and after pesticides application the level of significant was compared in order to evaluate the effect of pesticides in the number of pest on tobacco leaves. For the green leaves and dry leaves the level of significance was compare in order to evaluate the relationship between pesticides applied and the tobacco yield/weight.

4. Results

4.1. Insect Count before and after Pesticides Application

Results for insect count before and after applying Pesticides are shown in **Table 1**. Results show that the number of insects and aphids do not differ significantly across the five plots before pesticides application. Two weeks after pesticide application, the results showed that the untreated plot had more insects than the

treated plot. The results also showed that the number of insects for the untreated plot did not differ significantly from the plot treated with the standard pesticides. In the three level of Protector 700 WG, the results showed that the number of insects and aphids from the three plots did not differ significantly. During the fourth week after applying pesticides the results showed that there were no significantly difference for both insects and aphids for the untreated and treated plot. But the number of insects during the fourth week was lower in comparison to the second week after pesticide application.

4.2. Effect of Pesticides in Tobacco Yield

The reaping of matured leaves was done when matured. There were seven reapings, each reaping was weighed before being loaded into the curing barn. Curing was done for about seven days, and offloaded dried leaves were weighed and graded for each treatment. Grades were then valued by an expert classifier from the Tanzania Tobacco Board (TTB). Each grade was reweighed to obtain the saleable weight. From these grades, monetary values and grade indices were determined. Average green weight, dry weight, and grade index from each treatment were analyzed using the GenStat computer program.

Table 1. Effect of chemicals in control of aphids and whiteflies at Tumbi-Tabora, Mtanila-Chunya and Ulowa-Kahama.

	Tumbi		**Ulowa**		**Mtanila**	
Treatments	Aphids	Insects	Aphids	Insects	Aphids	Insects
Before Application	5.837b	3.486a	4.967a	2.941a	4.000a	3.667a
Two weeks after pesticide application						
Untreated	4.333a	1.6667a	2.709b	0.9577b	3.017a	1.004b
0.08 l/ha Bamethrin	3.6b	0.0073a	3.284a	0.0107a	3.267a	0.000a
15 g/20 l Protector	3.133b	0.000a	3.037a	0.0067a	2.937a	0.000a
20 g/l Protector	3ab	0.000a	3.000a	0.0000a	3.217ab	0.0067a
25 g/l Protector	2.533a	0.000a	2.467a	0.0000a	2.467a	0.1017a
Mean	3.3198	0.3348	2.8994	0.195	2.4867	0.22248
LSD	0.904 ns	0.01691	1.039	0.4732	1.039	0.4732
CV	13.5	26.3	28.6	9.9	23.8	18.4
Four weeks after pesticide application						
Untreated	1.0000b	0.0000b	1.6200b	1.90000b	2.1000b	2.0000b
0.08 l/h Bamethrine	1.6667a	0.33333b	1.4821b	0.3891a	1.6667b	0.4012a
15 g/20 l	0.6667a	0.0230a	0.8560a	0.0301a	0.7667a	0.0018a
20 g/20 l	0.3000a	0.0000a	0.3333a	0.0001a	0.3213a	0.0009a
25 g/20 l	0.3001a	0.4080a	0.3012a	0.0021a	0.1203a	0.0110a
Mean	0.7867	0.152866	0.91852	0.46428	0.995	0.48298
CV (%)	25	27.3	22	20.9	24.38	17.3
LSD	1.375	0.4861	1.465	0.586	1.394	0.236

Table 2 shows analysis results for green weight, dry weight and grade index from Tumbi, Ulowa and Mtanila. Results showed that the fresh and green weight were significant differences between the plot treated with the Protector at all level and the commonly used pesticide. Also, the plot with no pesticide application shows significant differences in fresh and dry weight. However, the yield was higher for the treated plot. The grade index results show that quality tobacco for the three sites was from the plot treated with Protector at 25 g/20 L followed by 20 g/20 L, but the difference in yield among these two levels of Protector does not differ significantly. Low quality tobacco from the three sites was from the untreated plot, followed by the plot treated with Bamethrin and 15 g/20 L level of protector.

5. Discussion

This study shows that the treated plot, had a higher weight than the untreated plot this is because pesticides application prevents pest and disease attack. The use of Protector 700 WG at the rate of 0.15 kg/ha yield more tobacco and had lower number of insects. Similar results were obtained by a study done by [7] on the effect of pesticides on tobacco aphids found that aphids populations reduced the yield up to 22% and 28%. In addition, the study also found that reductions in the price of cured leaves were as great as 7% and 9%. Thus, the combined effects on both yield and price resulted in observed losses on gross economic returns of 27%.

Also similar results were found by [5] in his study of testing the application of new pesticides called TANPRIDE, found that higher tobacco yield was obtained in the tobacco plot which was treated by pesticides [8]. The evaluation of the effect of deltamethrin in controlling budworms found that number of budworms decrease in the plot treated with deltamethrin.

Pests like white flies and Aphids have the tendency of feeding in the crop by sacking sap of the plant and cause serious vegetation damages [9].

Table 2. Effect of chemical application on tobacco yield and grade index at Mtanila, Ulowa and Tumbi.

	Tumbi			ULOWA			MTANILA		
Treatments	Gwtkg/ha	Drywghtkg/ha	Grade index	Gwghtkg/ha	Drywghtkg/ha	Grade Index	Gwghtkg/ha	Drywghtkg/ha	Grade index
No application	10900a	891a	0.737a	11224a	911a	0.6667a	10911a	947a	0.6233a
0.08 l/ha Bamethrin	15867b	1387b	0.81ab	16300b	1387b	0.7a	16202b	1337b	0.7b
15 g/20 l Protector	16517c	1395b	0.827b	16850b	1430b	0.7333a	16600b	1442b	0.8267c
20 g/20 l Protector	17720c	1570c	0.92c	17720c	1594c	0.9377b	17368c	1501c	0.9213d
25 g/20 l Protector	18907c	1645c	0.98c	19173d	1682c	1.004b	19225d	17892c	1.2e
Mean	15982	1378	0.89	16253	1401	0.8	16061	1423.2	0.9
LSD	624.4	116.5	0.0745	669.5	109.8	0.08	616.8	112.5	0.04
CV (%)	5.6	6.32	4.2	7.8	6.7	6.4	4.2	9.2	10.8

Generally pesticides are widely used in agricultural production to prevent or control pests, diseases, and other plant pathogens in order to reduce or eliminate yield losses and maintain high product quality [10].

6. Conclusion and Recommendation

The research results showed that PROTECTOR 700 WG with an active ingredient of Imidacloprid is highly effective than the commonly used pesticide. PROTECTOR 700 WG at all three rates yielded higher than other treatments and had few insect numbers in all three tested zones. These results show that using PROTECTOR 700 WG at the rate of 0.15 kg/ha can decrease pest attacks in tobacco and increase yield. Farmer are advised to use 0.15 kg/ha of the product by dissolving in 200 liter of water. For one hectare a farmer needs 150 gms of protector.

Acknowledgements

The authors wish to acknowledge to the following; Export Trading Group (ETG) for funding the evaluation of the Protector 700 WG, Tanzania Plant Health and Pesticide Authority (TPHPA) technical staff for trial supervision and review the agrochemical research report. Lastly to the TORITA staff and field Officer from the experimental site (Ulowa-Kahama, Tumbi-Tabora and Mtanila-Chunya) for their entire support during research execution.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Lskog, E., Kjellström, B., Gullberg, M., Katyega, M. and Chambala, W. (2005) Electrification Co-Operatives Bring New Light to Rural Tanzania. *Energy Policy*, **33**, 1299-1307. https://doi.org/10.1016/j.enpol.2003.12.006

[2] Marenya, P.P. and Barrett, C.B. (2007) Household-Level Determinants of Adoption of Improved Natural Resources Management Practices among Smallholder Farmers in Western Kenya. *Food Policy*, **32**, 515-536. https://doi.org/10.1016/j.foodpol.2006.10.002

[3] Badshah, H., Wajid, A., Saeed, M., Ullah, H., Ullah, F. and Zeb, Q. (2013) Screening of Elite Tobacco (*Nicotiana tabacum* L.) Genotypes for Their Physiological Traits and Resistant to Tobacco Budworm *Heliothis virescence* F. *Pakistan Journal of Botan*, **45**, 67.

[4] Hayes, T.B., Hansen, M., Kapuscinski, A.R., Locke, K.A. and Barnosky, A. (2017) From Silent Spring to Silent Night: Agrochemicals and the Anthropocene. *Elementa*: *Science of the Anthropocene*, **5**, 1-24. https://doi.org/10.1525/elementa.246

[5] Bucheyeki, T.L., Masibuka, K.C. and Shinanda, E.I. (2013). Evaluation of Introduced TANPRIDE 70 WDG Insecticide in Tobacco Production in Tanzania. *International Journal of Agricultural Science Research*, **2**, 185-190.

[6] Hassan, A.R. and Bakshi, K. (2005) Pest Management, Productivity and Environ-

ment. A Comparative Study of IPM and Convectional Farmers of Northern District of Bangladesh. *Pakstan Journal of Sicial Science*, **3**, 1007-1014.

[7] Reed, D.T. and Semtner, P.J. (1992) Effects of Tobacco Aphid (Homoptera: Aphididae) Populations on Flue-Cured Tobacco Production. *Journal of Economic Entomology*, **85**, 1963-1971. https://doi.org/10.1093/jee/85.5.1963

[8] Teran-Vargas, A.P., Rodriguez, J.C., Blanco, C.A., Martinez-Carrillo, J.L., Cibrian-Tovar, J., Sanchez-Arroyo, H., Rodriguez-del-bosque, L.A. and Stanley, D. (2005) Bollgard Cotton and Resistance of Tobacco Budworm (Lepidoptera: Noctuidae) to Conventional Insecticides in Southern Tamaulipas, Mexico. *Journal of Economic Entomology*, **98**, 2203-2209.

[9] Ndelemba, E.L. and Shenkalwa, E.M. (2004) Tumbaku ya mvuke: Mafunzo kwa wakulima wa tumbaku. (Flue Cured Tobacco Farmers Training Manual). Tobacco Research Institute of Tanzania, Tabora Tanzania.

[10] Damalas, C.A. and Eleftherohorinos, I.G. (2011) Pesticide Exposure, Safety Issues, and Risk Assessment Indicators. *International Journal of Environmental Research and Public Health*, **8**, 1402-1419. https://doi.org/10.3390/ijerph8051402