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FIELD EFFICACY STUDY OF PREMIX BACILLUS THURINGIENSIS var KURSTAKI HG207 AND BEAUVERIA BASSIANA HG208 IN HATAKE BIOINSECTICIDE AGAINST ARMYWORM ON CABBAGE

Trial Done by:

HATAKE GLOBAL SDN BHD

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INTRODUCTION

Spodoptera litura, commonly known as armyworm is one of the most important insect pests of agricultural crops in the Asian tropics.The species damage the plants through the larvae vigorous eating patterns, oftentimes leaving the leaves completely destroyed. Its potential impact on the many different cultivated crops, and subsequently the local agricultural economy, had led to serious efforts to control the pests.

Beauveria bassiana is a fungus grows naturally in soils and which is used as a biological insecticide to control pests such as arthropod species, termites, thrips, whiteflies and so on. As a biological insecticide, the spores are sprayed on crops and the fungus will grow on the insects once in contact. Within few days, the fungus will kill the infected insects.

Bacillus thuringiensis (Bt) is a natural occurring soil-borne bacterium that has been used for natural insect control. It is a spore-forming bacterium that produces a selectively toxic protein in the form of a crystal within the cell. The protein is differed depending on the subspecies of Bt, yielding a variance of Bt toxic to different insect species. When insect consumes the bacteria, toxic crystal protein is released and binds to specific receptor sites on the gut and causes starvation.

OBJECTIVE

1. To evaluate the efficacy of premix *Bacillus thuringiensis* var *Kurstaki* HG207 + *Beauveria bassiana* HG208 in Hatake Bioinsecticide against armyworm (*Spodoptera litura*) on cabbage.

MATERIALS AND METHODS

Table 1. Field trial details.

No.		Details
1	Location of trial	Brinchang, Cameron Highland
2	Design of trial	RCBD
3	No. of treatment	5
4	No. of replication	3
5	No. of plot	15
6	Plot size	0.8 m x 3.0 m
7	Treatment list	Refer Table 2
8	Target crop	Cabbage (*Brassica oleracea*)

9	Target pest	Armyworm (*Spodoptera litura*)
10	Type of sprayer	Knapsack sprayer
11	Type of nozzle	Adjustable cone nozzle
12	Spray volume	500 L/Ha
13	Method of application	Foliar spray
14	Spay interval	7 days
15	No. of application	2 applications (1/3/21, 8/3/21)
16	Weather	1/3/21 (Sunny at spraying, 0915; Sunny after spraying, 1115) 8/3/21 (Sunny at spraying, 0845; Cloudy after spraying, 1100)
17	Crop Stage	5 weeks after sowing
18	Trial Plot History	Cabbage
19	Percentage of Shade	Open Area, < 30%

Table 2. Treatment list

Treatments	**Rate of Application (g or ml/10 lit water)**	**Rate g or ml/ha**	**Replications**		
Control	-	-	1	9	12
T1. Hatake Bioinsecticide	7.5 g	375 g	2	10	13
T2. Hatake Bioinsecticide	15.0 g	750 g	3	6	14
T3. Hatake Bioinsecticide	22.5 g	1125 g	4	7	15
T4. Bactospeine WG	6.0 g	300 g	5	8	11

* Hatake Bioinsecticide is a premix wettable powder (WP) bio-insecticide which contain *Bacillus thuringiensis* var. *Kurstaki* HG207 (2.0 x 10^{10} cfu/gm) and *Beauveria bassiana* HG208 (5.0 x 10^{6}). Bactospeine WG is a wettable granule (WG) bio-insecticide which contain *B. thuringiensis* var. *Kurstaki* (32 000 iu/mg).

METHOD OF ASSESSMENT

i. Pre-assessment were carried out and assessments were done at 1 day after treatment (1 DA1stT), 4 DA1stT, 7 DA1sT, 1 day after second treatment (1 DA2ndT), 4 DA2ndT and 7 DA2ndT.

ii. 10 plants were sampled systematically from every trial plot and the number of armyworm was recorded.

iii. Percentage of mortality was calculated base on the formula showed below:

$$\text{Mortality rate} = \left(1 - \frac{T_a}{T_b} \times \frac{C_b}{C_a}\right) \times 100\,\%$$

Where: T_a = Population count of insect on treated plot after treatment

T_b = Population count of insect on treated plot before treatment

C_a = Population count of insect on untreated plot after treatment

C_b = Population count of insect on untreated plot before treatment

TRIAL DESIGN AND LAYOUT

11	12	13	14	15

6	7	8	9	10

1	2	3	4	5

RESULTS

Table 3. Effect of different insecticide treatments on cabbage's armyworm

Treatments	g/10 Lit water	Percent of Mortality, %					
		1 DA1stT	4 DA1stT	7 DA1stT	1 DA2ndT	4 DA2ndT	7 DA2ndT
T1	3	2.7 a	27.3 b	46.7 b	66.3 b	65.3 b	54.2 b
T2	6	4.8 a	33.4 ab	56.1 ab	70.6 ab	84.9 a	87.1 a
T3	9	2.9 a	42.6 a	63.8 a	83.2 a	84.1 a	89.3 a
T4	6	1.3 a	38.1 ab	57.6 ab	78.2 ab	90.4 a	91.6 a

Notes: Mean followed by different subscripted letters are significantly different from one to another at the probability level of p=0.05 by Least Significant Difference (LSD).

* 1 DA1stT = 1 Day After First Treatment; 1 DA2ndT = 1 Day After Second Treatment

Trial was conducted for two weeks. After 1 day of treatment (1 DA1stT), the percent of mortality was low. This was due to the *Bacillus thuringiensis* will be take some time to activate after consumed. After 4 days of application, mortality of the armyworm can be observed. Highest dose of Hatake Bioinsecticide (T3) gave more effective on killing of armyworm but it was not significant to T2 and T4. Besides, the percent of mortality was less than 50%.

After second bio-insecticides were applied, higher mortality rate observed. The population of armyworm was reduced significantly after 4 days of treatment. Instead of the T1, the other treatments had achieved more than 80% of mortality. And the effect of bio-insecticide remain the same after 7 days of second application. From the observation, bio-insecticide had to apply twice to achieve better control on armyworm.

CONCLUSION

The result showed Hatake Bioinsecticide at 15.0 g/10 liter water (750 g/Ha) gave a good performance and the recommended rate in controlling the *Spodoptera litura* at cabbage.

APPENDIX

Anova Table

Armyworm (1 DA1stT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	56.335	11.267	0.51	0.7648
Error	6	133.855	22.3091667		
Corrected Total	11	190.19			

R-Square	Coeff Var	Root MSE	1 DA1stT Mean
0.296204	160.1104	4.723258	2.95

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	18.25	6.08333333	0.27	0.8432
rep	2	38.085	19.0425	0.85	0.4718

Armyworm (4 DA1stT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	969.8025	193.9605	4.17	0.0555
Error	6	278.78	46.463333		
Corrected Total	11	1248.5825			

R-Square	Coeff Var	Root MSE	4 DA1stT Mean
0.776723	19.26898	6.816402	35.375

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	386.5825	128.8608333	2.77	0.133
rep	2	583.22	291.61	6.28	0.0338

Armyworm (7 DA1stT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F

Model	5	1988.536667	397.707333	6.3	0.0222
Error	6	378.953333	63.158889		
Corrected Total	11	2367.49			

R-Square	Coeff Var	Root MSE	7 DA1stT Mean
0.839935	14.17887	7.947257	56.05

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	450.916667	150.305556	2.38	0.1685
rep	2	1537.62	768.81	12.17	0.0077

Armyworm (1 DA2ndT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	706.2975	141.2595	2.16	0.1883
Error	6	392.871667	65.478611		
Corrected Total	11	1099.169167			

R-Square	Coeff Var	Root MSE	1 DA2ndT Mean
0.642574	10.84824	8.091886	74.59167

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	512.9758333	170.9919444	2.61	0.1463
rep	2	193.3216667	96.6608333	1.48	0.301

Armyworm (4 DA2ndT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1419.783333	283.956667	5.54	0.0299
Error	6	307.573333	51.262222		
Corrected Total	11	1727.356667			

R-Square	Coeff Var	Root MSE	4 DA2ndT Mean
0.82194	8.819254	7.159764	81.18333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	1080.656667	360.218889	7.03	0.0217
rep	2	339.126667	169.563333	3.31	0.1076

Armyworm (7 DA2ndT)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	3177.8425	635.5685	6.2	0.023
Error	6	614.6	102.433333		
Corrected Total	11	3792.4425			

R-Square	Coeff Var	Root MSE	7 DA2ndT Mean
0.837941	12.56869	10.12094	80.525

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	3	2809.4225	936.474167	9.14	0.0118
rep	2	368.42	184.21	1.8	0.2444