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VERIFICATION TRIAL OF BOTANICAL PESTICIDES AS CONTROL AGENTS AGAINST PESTS OF EGGPLANT *(Solanummelongena)*

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Abstract

Study was conducted on February 2012 to May 2012 at the IFSU Experimental Area, Nayon, Lamut, Ifugao, to verify the effectiveness of botanical pesticides as control agents against pests of eggplant (*Solanum melongena*).

The botanicals were collected, pounded into a pulp, mixed with water, and then filtered to produce a stock solution. This solution was then diluted with water and applied to the plants by conventional spraying using a knapsack sprayer. The botanicals were applied on the eggplants at weekly intervals starting from transplanting until a week prior to harvesting.

The effectiveness of the botanicals was established using the randomized complete block design as experimental design with three treatments, replicated four times. The treatments were: *kakawate* leaves (T1), neem leaf and fruit (T2), and makabuhay (T3) extracts with the synthetic pesticide (T0) treatment as the control.

Results of the study shows that the highest reduction of pest is from *kakawate* extract (T2) followed by makabuhay extract (T3) and synthetic pesticide (T0). Neem extract (T2) has the lowest number of pest reduction. Furthermore, the most common eggplant pest is aphids, with an average weekly incidence of 573.

Keywords: *Botanical plants, synthetic pesticides, treatments*

INTRODUCTION

The Philippines is predominantly an agricultural nation where a large area of its geographical landscape is devoted to farming, gardening, and a variety of other horticultural and agronomic endeavors. Throughout ancient history, man has relied mostly on indigenous practices to manage their agricultural activities. As it is today, pests and other destructive insects are also a central problem among farmers and agricultural practitioners even before the advent of modern methods; and it may be fair to say that managing these farm nuisances posed headaches to the olden-day agricultural growers.

In time, man is able to discover that sap extracts of some botanical plants can be made to counter or minimize the destructive impact of pests. Although there is no noted formal documentation or scientific proof of such practices, the knowledge on the effects of these naturally-existing combatants is handed down from generation to generation by word of mouth and anecdotal stories up to this day.

Finally, industrialization caught up with the agricultural business, and pesticides are introduced as potent formulas. Synthetic pesticides are widely available, easy to use and very effective in controlling a wide variety of pests. These characteristics have paved the way for the wide acceptance and utilization of these chemicals, now an integral component of the conventional farming system. This integration has put the once ingenious indigenous methods simply a part of history.

Synthetic pesticides, however, are an added burden to local farmers. In addition to that, long term exposure, either external through skin contact or ingested or through the well-established "residual effect", have been scientifically proven to cause ill health effects, ranging from mild skin diseases to cancer. Thus, if using these alternative organic methods can preserve product quality and yield, then it would be for the greater benefit of the local farmers, both financially and health-wise.

This study, then, attempts to answer the question "How effective are botanical pesticides as control agents against insect pests, specifically on eggplant, under local conditions?"

Given the incessant rising costs of goods, the need for alternative methods comes as a practical choice. This is especially true for small scale eggplant farmers located in upland and far flung rural areas where farming is mainly done for subsistence, with what little left sold to augment income. Since produce is essentially both for personal consumption and at the same time for commercial purposes, product quality and yield are of the essence.

With the proven capability of organic pesticides to be as effective as conventional pesticides, product quality and yield can be preserved without the additional costs and health risks associated with conventional pesticides.

Although studies on botanical pesticides has been conducted locally during the early 80's, these has not gained wide acceptance due to the laborious nature of preparing the botanical concoction prior to application. Compared with the easy-to-use conventional pesticides, botanicals are a generation behind.

Times, however, are changing. Man is becoming more and more conscious of his food and his food source. This development has encouraged the resurgence of pesticide free and organic food. With this, conventional farming systems need to adapt to the changing needs of man. This study, then, presents a window into a healthy and pesticide free farming system.

This study aims to establish the effects of three botanical plants: **neem, makabuhay and madre de cacao/*kakawate*** against insect pests of eggplant. Specifically, the study aims to compare the effectiveness of these botanicals against common insect pests of eggplant and compare which among the treatments produced the best yield. And lastly, this study also aims to identify the pest that can be controlled by the botanicals.

METHODOLOGY

Land Preparation

A well-drained area of 125 sq. meter of land was plowed and harrowed twice to eliminate weeds and plant debris. Chicken manure was mixed with the soil. It was pulverized and leveled. The area was divided into four equal blocks, with each block a replicate of the study. An alley of 1 meter was laid between the sub-blocks. Each sub-block was further subdivided into four plots each with a dimension of 1x5 meter per plot. In between plots an alley of 1 meter was laid. The same procedure was done in all the replications. Plastic mulching was used in every plot to control weeds and maintain moisture of the soil.

The botanical pesticides were the treatments in the four crops category. The Randomized Complete Block Design (RCBD) was employed in conducting the trials. The different treatments are as follows;

Treatment 1- Kakawate leaves extracts

Treatment 2- Neem leaf and fruit extracts

Treatment 3- Makabuhay leaf and stem extract

Treatment 0- Bida (control group)

Crop Production

Preparation of Planting Materials

Healthy seeds of eggplant were bought from an agricultural supply store. These were broadcasted on a separate seedbed. The seedbed was well cultivated and free of weeds. With proper watering, it took 6-8 days for the seedlings to emerge.

Planting and Transplanting

After two weeks, healthy seedlings with four leaves were transplanted on the prepared plots. The area was irrigated before planting. Seedlings were watered thoroughly before transplanting. The planting distance per hill was two feet. Transplanting was done in the late afternoon to avoid plant stress.

Fertilization

Chicken manure was used as a basal fertilizer applied before transplanting, following eggplant fertilizer recommendations. Side dressing was done one month after transplanting.

Care and management

Irrigation was done every after three (3) days by manual watering using watering can. The use of plastic mulching suppressed the growth of weeds. Only few weeds emerged but were removed manually by uprooting them. To control the pest of the crop, the different botanicals were used.

Preparation of botanicals

The following procedures describe the steps undertaken in preparing the botanicals. Pest free plants were selected during the selection of the different botanicals. Soft Stems and leaves were collected from Kakawate, stems from Makabuhay, and leaves and fruits from Neem tree.

The botanicals were cleaned and washed with water to remove unwanted debris. For Easy extraction, the botanicals were chopped with a bolo or knife and pounded with mortar to produce the juice.

The ratios of the botanicals to water are as follows: 1 kilo chopped kakawate is to 1 liter of water, 5 grams chopped makabuhay stem is to 125 ml of water, 30 grams chopped neem leaves and fruits are to 1 liter of water. After mixing, leave it for a while and filter the juice to avoid clogging of the spray tank during the application of the solution. The juice produced is the stock solution. The dosage of spraying was 2 tablespoons per liter of water.

Intervals of application

Botanical solution was applied late in the afternoon, once a week, under cool weather condition to avoid the leaves of the plants from being burned.

Harvesting

Harvesting started 65 days after transplanting. The fruits were picked when one half to one third its full size at maturity. Other maturity indicators such as firmness and skin quality were used to determine the readiness of the plant for harvest. Harvesting was done once a week. Mature fruits that are soft and shiny are selected. While the deformed and damaged fruits were harvested but separated to prevent the spreading of pests and diseases. Moreover, frequent harvesting can reduce their damage from fruit borers.

Data Gathering

Weekly height of eggplant was measured from the ground to the tip of the shoot using a ruler. Height measurements were taken and recorded until the plants' flowering stage. Height measurements ceased at this stage since the eggplants also cease to grow vertically.

Just after transplanting, damaging pests attacking the plants were identified, counted and recorded. A day after the pests were counted, the botanical pesticides were applied. This cannot be done on the same day due to the tedious and time consuming nature of pest counting and preparation of the botanicals.

A day after applying the botanicals, the pest population was again counted and recorded. This routine was repeated until harvest.

Upon maturity, all matured fruits were harvested. These were gathered and sorted. Sorting was done to separate the marketable and non-marketable fruits. Non-marketable consisted of those damaged or infected fruits.

Using a weighing scale, the weight of the marketable and non-marketable fruits was measured and recorded. Also, these were counted and recorded.

RESULTS AND DISCUSSION

Data on plant height and the number of marketable and non-marketable fruits produced by the plants are studied and analyzed. Also, the pest incidence is analyzed using the pest count data before and after administering the pesticides. These parameters are chosen to establish the effect of the pesticides on the overall health and fruit bearing capacity of the plants.

The damage caused by insect pests on the plants slows down the growth and development of the plants. Pests damage the leaves causing the reduction in photosynthetic activity, thus, hampering growth. Furthermore, proper fruit development is impeded when pests zap the juice of the eggplant fruits. The application of pesticides prevents the pests from interfering with the natural growth of the plant.

Plant Height

Data gathered on the weekly plant height is presented in the following figure.

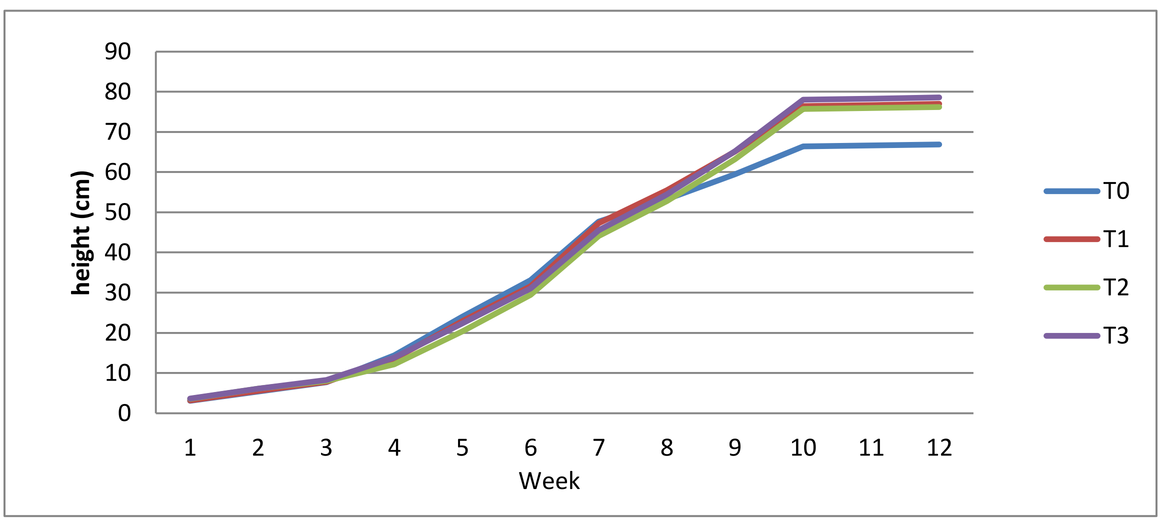

Fig. 14.Weekly average plant height.

The colored lines show the average weekly height measurement of the eggplants per treatment. Starting at week 8, the average height of the eggplants treated with botanical pesticides on the data shows an evident height outperformance over those with synthetic materials. This may be explained by the fact that the botanicals also contain natural fertilizers which are applied in a foliar form when these are applied as pesticides, a situation absent in synthetic pesticides. There is also a notable stunted growth starting at week 10, where the subject plants have already reached its maximum height and have already started flowering.

There is also a notable slow growth period of all plants during the first to third week. When the study is conducted, there is low rainfall which caused the slow growth of the plants; however, the plants have recovered starting on the fifth week, as is evidenced by the marginal increase in height until the ninth week.

An Analysis of Variance (ANOVA) is performed on the weekly average plant height data to determine if there is significant difference in the weekly average height per treatment.The following table shows the summary of the ANOVA, computed manually.

Table 1. Analysis of Variance at Weekly Average Height

SOURCE OF VARIATION	**Df**	**∑X^2**	**Ẋ**	**F**	**F**	
					5%	1%
BLOCK	3	1.25	0.42			
TREATMENT	3	0.15	0.05	0.62	3.86	6.99
ERROR	9	0.61	0.08			
TOTAL	15	2.01				

Cv= 7.37

df=Degrees of freedom, ∑X^2=sum of squares, Ẋ=Mean square

F= computed f- value, f=tabular f value

The preceding table shows that there is no significant difference in the weekly average plant height with respect to the treatments. In other words, the botanical pesticides and the synthetic pesticides have the same effect on the height of the plant.

Incidence of Pests

The following pests are observed to be feeding on the plants during their vegetative stage: leafhoppers, spider mites, flea beetles, white flies, aphids, leaf folders and cutworms. During the fruiting stage, eggplant shoot borer and fruit borer were also observed. However, these are effectively controlled by cutting the infected stem/shoot and spraying the plants with the different treatments. All damaged fruits are also removed during harvesting to prevent the spread of pests and diseases.

The tables below show the summary of the pest incidence before and after pesticide application.

Table 2. Average weekly number of pests before pesticide application.

PESTS	PEST INCIDENCE								
	w1	w2	w3	w4	w5	w6	w7	total	mean
Leafhoppers			4	29	2	8	117	160	22.9
Spidermites	9	20	17		7	8	7	68	9.7
Flea beetle			17	25	18	13	42	115	16.4
Shoot borer						2	10	12	1.7
Whiteflies	65	49	61	9	10	28	9	231	33.0
Aphids		98	161	172	26	3554		4011	573.0
Eggplant lacebug	13	22						35	5.0
Stem borer		9					3	12	1.7
Thrips					14	72		86	12.3
Cutworm	4	6	5	8	8		1	32	4.6
Yellow beetle		3		9	5	23		40	5.7
Spotted beetle					3		2	5	0.7
Leaf folder		1	2		2	1	2	8	1.1

Table 3. Average weekly number of pests after pesticide application.

	PEST INCIDENCE																											
PEST	**w1**				**w2**				**w3**				**w4**				**w5**				**w6**				**w7**			
	t0	t1	t2	t3	t0	t1	t2	t3	t0	t1	t2	t3	t0	t1	t2	t3	t0	t1	t2	t3	t0	t1	t2	t3	t0	t1	t2	t3
Leafhoppers	0	0	0	0	0	0	0	0	0	1	1	0	7	11	14	10	0	0	0	1	0	7	4	2	25	19	17	18
Spider mites	0	0	1	3	1	3	0	0	0	3	0	4	0	0	0	1	2	0	0	0	0	0	1	1	0	0	0	0
Flea beetle	0	0	0	0	0	0	0	0	0	7	7	4	0	2	4	3	0	0	0	0	0	4	10	4	2	3	0	4
Shoot borer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Whiteflies	8	6	8	8	3	0	7	0	10	7	10	9	9	2	0	1	0	0	0	0	3	3	3	3	0	0	0	0
Aphids	0	0	0	0	4	5	0	0	4	24	22	31	13	42	71	70	0	0	0	0	21	0	0	18	0	0	0	0
Eggplant lacebug	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stem borer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Thrips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	4	0	0	0	0
Cutworm	0	0	1	0	0	0	0	0	1	5	1	0	1	0	0	0	0	0	0	1	1	0	4	0	0	0	0	0
Yellow beetle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Spotted beetle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0	0	0	0	0
Leaf folder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

A pest count is done before and after pesticide application to establish the effect of the botanicals on pest population. It involves ten daily runs of "before-and-after effect" data gathering spread out from February 25 to April 15, 2012. Pre-counting of pests is conducted prior to application of pesticides (treatments). The pests are recounted the following day and the difference between the pre and post counting is recorded. This difference represents the pest reduction.

Data on Table 4 shows the average reduction in pests after the application of treatment. Generally the average numbers of pests after application are greatly reduced. Use of kakawate extract (T1) shows the highest reduction at –39.07 unit pests, followed by the application of makabuhay extract (T3) at -38.9811 unit pests relatively close to the application of synthetic at -37.3929. Neem extract (T2) exhibits the least decrease at –21.27 unit pests.

Table 4. Average reduction of pests after pesticide application

TREATMENT	MEAN	N	Std. Deviation
0	-37.3929	28	86.36929
1	-39.0714	28	89.3246
2	-21.2682	28	58.47251
3	-38.9811	28	99.02649
TOTAL	-34.1784	112	83.83787
F= 0.682			p-value= 0.565

Where 0= synthetic, 1=kakawate, 2=neem, 3=makabuhay

Using Analysis of Variance (ANOVA) (Table 5), the null hypothesis that the treatment means are statistically similar is tested against the alternative that there is at least one treatment mean that is significantly different in its effects.

Table 5. Analysis of Variance

	Test of Between-Subject Effects				
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig**
Corrected Model	21075.203	6	3512.534	0.468	0.818
Intercept	130834.204	1	130834.2	18.097	0
Block	14802.838	3	4934.279	0.682	0.565
Treatment	6272.364	3	2090.788	0.289	0.833
Error	759120.672	105	7229.717		
Total	911029.672	112			
Corrected Total	780195.468	111			

a. R Squared = .027 (Adjusted R Squared= -.029)

Based on the test at 95% confidence level, the blocking effect come up with a p- value of 0.565, which is way above the test benchmark of 5% alpha. This implies that there is no sufficient evidence, as manifested by the data, that blocking using adjacent plots for purposes of determining strength variations of the pesticides tested, is necessary.

As for the treatment effects, the null hypothesis cannot be rejected. The data suggests that there is no significant difference in the repellant effect of the four pesticides evaluated. While the mean effects are relatively not the same, this is not decisive proof to claim that one is indeed stronger than the other. Such observation may have been merely due to some random confounding factors. The ANOVA test yielded a p-value of 0.833, which is notably greater than the benchmark significance level of 0.05.

Additionally, the results indicate that Ho is accepted. In other words, the hypothesis that the resulting outcome of the organic pesticides (neem, kakawate and makabuhay) is the same as that of the synthetic formulation is accepted.

Yield

Number of Fruits Gathered

The natural fruit-bearing life of an eggplant resembles that of a bell-shaped curve; that is when the plant starts to bear fruits at some point, assumes a gradual increase, peaks, and then eventually starts to degenerate (Fig. 15).

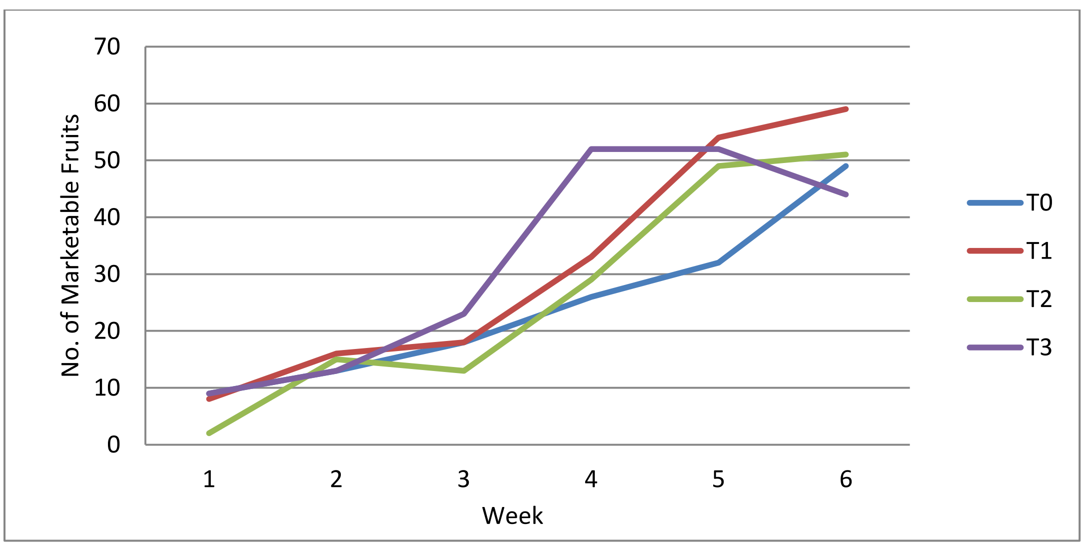

Fig. 15. Graph showing the number of marketable fruits per week

Based on the growth observations, it can be discerned that eggplants treated with synthetic pesticides tend to have a longer fruit bearing period than those treated with botanicals. Eggplants treated with treatment 3, all else equal, seemed to have started a reduction in yield at week 5 while those of the two botanical are showing signs of gradual tapering-off as evidenced by the slackening slope after the steep ascent from week 3 to week 4.

Average Number of Marketable Fruits

The yield as far as the number of marketable fruits is shown in table 6. The highest yielder is for the plants in treatments 1 (kakawate extract) and treatment 3 (makabuhay extract) with an average number of 8 fruits per plant. This is closely followed by treatment 2 (neem extract) with 7 fruits per plant and the least is treatment 0 (control) with an average yield of 6.

Table 6. Average number of marketable fruits.

TREATMENT	BLOCKS				Total	Mean
	I	II	III	IV		
T0	3	9	5	8	25	6.25
T1	6	9	9	8	32	8
T2	9	5	4	9	27	6.75
T3	8	14	7	3	32	8
Total	26	34	25	28	116	
Mean	6.5	8.5	6.25	7		7.25

The result of statistical analysis (Table 7) reveals no apparent difference on the mean number of fruits per treatment. In other words the yield of the plants treat with botanicals and synthetic has almost the same quality and number of fruit that they produce every week. Also, the blocking factor doesn't seem to offer meaningful effect in so far as the average number of marketable fruits is involved.

Table 7. Analysis of Variance

SOURCE OF VARIATION	df	∑X^2	Ẋ	F	F	
					5%	1%
					5%	1%
BLOCK	3	22.5	7.5			
TREATMENT	3	9.5	3.17	0.32	3.86	6.99
ERROR	9	89	9.9			
TOTAL	15	121				

cv- 4.34 % p- value < 0.05 -S

p- value > 0.05 -NS

df=Degrees of freedom, ∑X^2=sum of squares, Ẋ=Mean square

F= computed f- value, f=tabular f value

Average Number of Non-marketable Fruits

Table 8 shows the frequency distribution summary of the number of non-marketable fruits. Synthetic (T0), kakawate (T1) and makabuhay (T3) applications all have an average of 4 non-marketable fruits (rounded-off to the next higher integer) while that of the neem extract only has 3 (rounded-off to the next higher integer). As to blocking means, blocks two, three and four all suggest an average of 4 non-marketable fruits (rounded-off to the next higher integer) with the first blocking showing the least number at 2.

Table 8. Average number of non-marketable fruits

TREATMENT	BLOCKS				TOTAL	MEAN
	I	II	III	IV		
T0	1	5	4	4	14	3.5
T1	1	5	4	4	14	3.5
T2	3	2	2	3	10	2.5
T3	3	4	4	2	13	3.25
Total	8	16	14	13	51	
Mean	2	4	3.5	3.25		3.19

The statistical analysis shows that the numbers of damaged fruits of all the treatments are similar. The statistical ANOVA test for equality of means complements the result of the observed average number of non-marketable fruits, that is, blocking has no bearing on the experimental test and the treatment effects are apparently similar.

Table 9. Analysis of Variance

SOURCE OF VARIATION	Df	∑X^2	Ẋ	F	F 5%	F 1%
BLOCK	3	8.69	2.9			
TREATMENT	3	2.69	0.9	0. 62	3.86	6.99
ERROR	9	13.06	1.45			
TOTAL	15	24.44				

cv- 37.75 %

p- value < 0.05 -S
p- value > 0.05 -NS

df=Degrees of freedom, ∑X^2=sum of squares, Ẋ=Mean square

F= computed f- value, f=tabular f value

Average Weight of Marketable Fruits(grams)

Shown in table 10 is the average weight of marketable fruits expressed in grams. The mean weights of marketable fruits in a descending order are 616.25 g., 605 g, 563 g, and 439.25 g. For T1, T3,T2 and T0 respectively.

Table 10.Average weight of marketable fruits (grams)

TREATMENT	BLOCKS				Total	Mean
	I	II	III	IV		
T0	149	629	400	579	1757	439.25
T1	430	696	718	621	2465	616.25
T2	811	340	273	828	2252	563
T3	683	847	604	286	2420	605
Total	2073	2512	1995	2314	8894	
Mean	518.25	628	498.75	578.5		555.88

The analysis of variance (Table 11) reveals insignificant result. This means that all the plants sprayed with the different treatments had produced fruit that are comparable in terms of weight. Blocking, at the same time, is not necessary.

Table 11. Analysis of Variance

SOURCE OF VARIATION	df	∑X^2	Ẋ	F	f	
					5%	1%
BLOCK	3	41571.25	13857.08			
TREATMENT	3	78842.25	26.280.75	0.41	3.86	6.99
ERROR	9	142.25	64793.58			
TOTAL	15	703555.8				

cv- 45.79 % p- value < 0.05 –S

p- value > 0.05 –NS

df=Degrees of freedom, ∑X^2=sum of squares, Ẋ=Mean square

F= computed f- value, f=tabular f value

Average Weight of Non-marketable Fruits (grams)

Table 12 shows the average weight of damaged fruitscollected on the different treatments. Application of neem extracts (T2) has produced the least average weight of non-marketable fruits at 132g followed by makabuhay (T3) at 198.5g. Kakawate on one hand has the highest average weight at

245.75g (T1) while the synthetic formula records an average of 204.5g (T0). Across blocks, the second set of plots register the highest average weight of defective produce at 227.75g followed by sets three and four at close distance of 202.5g and 201.75g, respectively. The first blocking shows a relatively lower average at 137.5g.

Table 12. Average weight of non-marketable fruits(grams)

TREATMENT	BLOCKS				Total	Mean
	I	II	III	IV		
T0	29	300	236	253	818	204.5
T1	169	285	261	223	938	245.75
T2	178	79	97	174	528	132
T3	174	247	216	157	794	198.5
Total	550	911	810	807	3078	
Mean	137.5	227.75	202.5	201.75		195.19

The statistical analysis of the data (Table 13) shows that the weight of the collected damaged fruit is comparable on the different treatments. While there seems to bean observed difference across block and treatment means, the statistical test indicates that, all else equal, there exists no apparent variation in the average weight of the damaged fruits as far as blocking and treatment applications are concerned.

Table 13. Analysis of Variance

SOURCE OF VARIATION	Df	∑X^2	Ẋ	F	F	
					5%	1%
BLOCK	3	17812.25	5937.42			
TREATMENT	3	22416.75	7274.25	1.46 ns	3.86	6.99
ERROR	9	46022.75	5113.64			
TOTAL	15	86251.75				

cv- 36.64 %

p- value < 0.05 -S

p- value > 0.05 -NS

df=Degrees of freedom, ∑X^2=sum of squares, Ẋ=Mean square

F= computed f- value, f=tabular f value

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study is conducted at the experimental area of the Ifugao State University, Nayon, Lamut, Ifugao from February 2012 to May 2012. It aims to verify the selected botanical pesticides as control agents against pests of eggplant.

The experimental design is conducted to determine the relative efficiency of four treatment factors, namely synthetic pesticide and three botanical extracts from neem, kakawate and makabuhay in the yield, height and pest incidence on eggplants. Blocking is introduced in the design to account for the variable effects with respect to plot locations. The study is conducted in a span of seven weeks starting from the time that the eggplants started to bear fruit. Pest incidence is monitored daily after prior applications of the treatments while height measurement is reckoned one week after transplanting until the end of the fruit bearing life of the plants. Yield is measured in terms of the number of fruits as well as the average weights throughout the fruit bearing life of the experimental units. Both marketable and non-marketable produce are recorded for comparison.

ANOVA tests are conducted to determine whether or not there exist significant differences in pest incidence as well as in the average number and weights of fruits for both marketable and non-marketable categories. In all the tests, blocking appears to be a non-factor in the experiment. Furthermore, treatment effects do not show general yield variations.

The results reveal that for the growth and yield of eggplant there is no significant differences among the treatment means as shown in the corresponding statistical analysis, but as to the effect of the different treatments against pest, the highest reduction of pest is on kakawate extract (T1) followed by makabuhay extract (T3) which is closely followed by the control (T0), and the lowest pest reduction is the neem extract (T2).

Conclusion

Based on the findings of the study, botanical pesticides have the same effect as that of the synthetic formulation in terms of reducing pests of eggplant. Yield is also apparently the same for all.

Be as it may, the natural implication would be that botanical pesticides provide an effective substitute for the synthetic formulation. The results exhibit that the three botanicals are as potent in controlling pests as their synthetic counterparts which lead the researcher to conjure that any one of the three organic materials may be used. Such result is interesting in as much as it establishes the economic benefits from using botanicals pesticides.

Yield also appears the same for all. Thus, there is reason to believe that, assuming conditions are the same, botanical pesticides offer the same fruit quality compared to using synthetic ones.

Thus, in view of cost considerations, among others, the use of kakawate, neem and makabuhayextracts to control for pests and the consequential impact on yield are as effective as the synthetic formulation.

Recommendations

In light of the conclusions some recommendations are set forth that there should be a separate study to establish which among the botanicals is most potent. Another study on the effect of other botanicals in other high value crop is also recommended. It is interesting to know how long these botanicals affect the size and weight of the fruit. Also, the combination of the different botanicals could give a better result. This possibility should be studied further.

Moreover, given the almost homogenous soil conditions, blocking may no longer be necessary in future studies of similar circumstances. An alternative would be to introduce blocking based on heterogeneous settings, e.g., consider conditions of geographic proximities or soil fertilities.

The experimental design conducted is inconclusive of such natural pattern due to the limited time allotted to conduct the study but such could be covered separately in a more extensive manner independent of the objectives of this research.

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APPENDICES

APPENDIX A

Experimental Lay out

Block 1

T0	T1	T2	T3

Block 2

T1	T0	T3	T2

Block 3

T2	T3	T0	T1

Block 4

T2	T1	T0	T3

T1- Kakawate extract

T2- Neem tree extract

T3- Makabuhay extract

T0- Control (Bida)

APPENDIX B

Weekly Height of Eggplant (cm)

first week

		replications			total	mean
treatment	B1	B2	B3	B4		
0	4.6	3.63	3.83	3.5	15.56	3.89
1	3.86	3.7	3.96	3.23	14.75	3.15
2	4.26	3.56	4.26	3.7	15.78	3.556
3	3.86	4.06	4.13	3.3	15.35	3.67

second week

		replication				
treatment	B1	B2	B3	B4	total	mean
0	6.6	6.35	6.77	7.11	26.83	5.366
1	6.6	6.52	7.11	6.6	26.83	5.566
2	7.11	7.62	7.2	6.5	28.43	6.086
3	7.28	6.86	6.86	6.7	27.7	6.14

third week

		replications				
treatment	B1	B2	B3	B4	total	mean
0	10.33	9.2	9.35	9.7	38.58	7.716
1	8.46	9.4	10.96	9.16	37.98	7.796
2	9	8.3	9.3	11.66	38.26	8.052
3	9.6	9.9	10.26	8.5	38.26	8.252

4th week

		replications				
Treatment	B1	B2	B3	B4	Total	mean
0	19.33	18.35	18	16.34	72.02	14.404
1	15.7	14.33	16.7	19.7	66.43	13.486
2	17	11.6	13	17	58.6	12.12
3	16	20	18.33	12	66.33	13.866

5th week

Treatment	B1	replications B2	B3	B4	Total	mean
0	29.33	30.66	31	29	119.99	23.998
1	25.66	28	27	33	113.66	22.932
2	28	19.66	23.66	28.66	99.98	20.396
3	30	30	31.66	17	108.66	22.332

6th week

Treatment	B1	replications B2	B3	B4	Total	mean
0	40.5	44.5	41.7	39	165.7	33.14
1	35.7	39	38	44.2	156.9	31.58
2	38.6	30.2	37.5	39	145.3	29.46
3	40	41	42	29	152	31

7th week

Treatment	B1	replications B2	B3	B4	Total	mean
0	59.9	58	59.63	61	238.53	47.706
1	58	55.13	62.5	59.6	235.23	47.246
2	55.7	50.76	55.2	56.8	218.46	44.092
3	55.5	61.83	60.3	46.86	224.49	45.498

8th week

Treatment	B1	replications B2	B3	B4	Total	mean
0	60.33	69.67	70	66.33	266.33	53.266
1	67.33	67	72.67	69.33	276.33	55.466
2	66	66.66	63	66.33	261.99	52.798
3	69	72	71.3	57	269.3	54.46

APPENDIX C

Weight of marketable fruits

April 9,2012

	Weight of marketable fruits / 8 sample plants				
		Replications			
Treatment	B1	B2	B3	B4	total
0	50	100	120	250	520
1	150	125	50	180	505
2	0	0	60	75	135
3	70	380	80	0	530

April 17,2012

	Weight of marketable fruits / 8 sample plants				
		Replications			
Treatment	B1	B2	B3	B4	total
0	100	120	250	200	670
1	300	175	375	200	1050
2	850	0	0	320	1170
3	130	450	150	0	730

April 20,2012

	Weight of marketable fruits / 8 sample plants				
		Replications			
Treatment	B1	B2	B3	B4	TOTAL
0	100	250	200	350	900
1	150	75	400	420	1045
2	220	80	175	300	775
3	375	650	850	0	1875

April 25,2012

	Weight of marketable fruits (grams)				
		Replications			
Treatment	B1	B2	B3	B4	Total
T0	145	700	650	350	1845
T1	360	645	900	600	2505
T2	760	300	225	950	2235
T3	950	450	700	250	2350

April 28, 2012

	Weight of marketable fruits (grams)				
		Replications			
Treatment	B1	B2	B3	B4	Total
T0	250	850	600	600	2300
T1	450	1050	800	950	3250
T2	1000	200	250	1300	2750
T3	1055	1100	800	300	3255

May 3, 2012

	Weight of marketable fruits (grams)				
		Replications			
Treatment	B1	B2	B3	B4	Total
T0	150	780	400	700	2030
T1	750	1300	1100	1200	4350
T2	1550	650	700	1350	4250
T3	1100	1600	1000	325	4025

May 12, 2012

	Weight of marketable fruits (grams)				
		Replications			
Treatment	B1	B2	B3	B4	Total
T0	250	1600	580	1600	4030
T1	850	1500	1400	800	4550
T2	1300	1150	500	1500	4450
T3	1100	1300	650	780	3830

Weight of non-marketable fruits

Average weight of non-marketable fruits(grams)

TREATMENT	**BLOCKS**				**Total**	**Mean**
	I	**II**	**III**	**IV**		
T0	29	300	236	253	818	204.5
T1	169	285	261	223	938	245.75
T2	178	79	97	174	528	132
T3	174	247	216	157	794	198.5
Total	550	911	810	807	3078	
Mean	137.5	227.75	202.5	201.75		195.19

Number of marketable fruits.

April 9,2012

	Number of marketable fruits / 8 sample plants				
	Replications				
Treatment	B1	B2	B3	B4	total
0	1	2	2	4	9
1	3	2	1	2	8
2	0	0	1	1	2
3	1	6	2	0	9

April 17 2012

	Number of marketable fruits / 8 sample plants				
	Replications				
Treatment	B1	B2	B3	B4	total
0	2	2	5	4	13
1	5	2	5	4	16
2	9	0	0	6	15
3	3	7	3	0	13

April 20,2012

Number of marketable fruits/ 8 sample

replications

Treatment	B1	B2	B3	B4	TOTAL
0	2	5	4	7	18
1	3	1	6	8	18
2	4	1	2	6	13
3	6	7	10	0	23

April 9,2012

Number of marketable fruits / 8 sample plants

replications

Treatment	B1	B2	B3	B4	total
0	1	2	2	4	9
1	3	2	1	2	8
2	0	0	1	1	2
3	1	6	2	0	9

April 17, 2012

Number of marketable fruits / 8 sample plants

replications

Treatment	B1	B2	B3	B4	total
0	2	2	5	4	13
1	5	2	5	4	16
2	9	0	0	6	15
3	3	7	3	0	13

April 20,2012

Number of marketable fruits/ 8 sample

replications

Treatment	B1	B2	B3	B4	TOTAL

0	2	5	4	7	18
1	3	1	6	8	18
2	4	1	2	6	13
3	6	7	10	0	23

April 25,2012

	Number of marketable fruits				
	replications				
Treatment	B1	B2	B3	B4	TOTAL
T0	3	9	7	7	26
T1	5	8	12	8	33
T2	9	4	4	12	29
T3	11	29	9	3	52

May 2, 2012

	Number of marketable fruits (grams)				
	replications				
Treatment	B1	B2	B3	B4	Total
T0	3	15	5	9	32
T1	9	20	12	13	54
T2	18	8	9	14	49
T3	16	19	12	5	52

May 8, 2012

	Number of marketable fruits				
	replications				
Treatment	B1	B2	B3	B4	Total
T0	4	20	8	17	49
T1	11	19	19	10	59
T2	14	15	5	17	51
T3	12	16	7	9	44

APPENDIX D

Photo Documentations

Fig. 1. Harrowing the plots.

Fig. 2. Leveling the plots.

Fig 3. Plastic mulching.

Fig. 4. Chicken manure in sacks.

Fig. 5. The researcher watering
the plants using watering can.

Fig. 6 Kakawate leaves .

Fig. 7. Makabuhay stems.

Fig. 8. Neem tree.

Fig. 9. The researcher pounding the
botanicals using mortar.

Fig. 10. Weighing of botanicals.

Fig. 11.The researcher weighing and recording eggplant fruit.

Fig. 12.The researcher monitoring insects

Fig.13.Harvested eggplant being weighed in a weighing scale.

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