Efficacy of some plant materials for the control of field insect pests of Water Melon Citrullus lanatus (Thunberg) Matsum & Nakai

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Abstract

Three plant materials were tested in the field for the possibility of using them as protectants or curative pesticide against the field insect pest of water melon. The plant materials were **Azacdirachta indica** (neem), (leaf) **Ricinus cumunis** (castor leaf), **Euphorbia heterophylla** (leaf). Nuvacron and Decis, synthetic field insecticides, were also used alongside the three plant materials while there was an untreated control which acted as standard check. The result from the study shows that Neam leaf (**Azacdirachta indica**) outperformed the other two plant materials with respect to yield parameters. There was no significant difference in the growth of melon in meam treated plots and other plant materials in the first year but significantly different in the second year of the experiment. Decis and Nuvacron outperformed all the plant materials with respect to the tested parameters except the flowering rate. Decis was the best among the tested treatments.

Keywords: Efficacy, plant materials, Synthetic pesticides, insect pest.

Introduction

In Nigeria, water melon **Citrullus lanatus** (Thunberg) Matsum & Nakai) is grown all over the country, the Northern states being the highest production area due to the climatic condition that favour its growth. In the Southern guinea savannah, the crop is planted in March and September for early and late crop respectively. In the Northern Guinea to Sahel savannah, it is best in June/July for rainy season crop and October March for dry season crop. The area under water melon cultivation in Africa, Asia and North America were respectively 124,000ha, 1463,000ha, 135,000ha, while their productions were 1979600MT, 29908000MT and 2509MT respectively.

Water melon is an important fruit crop in Nigeria and Niger Republic. The fruit is eaten raw as fresh juicy desert particularly during Ramadan fasting period. The seeds are generally ground to form flour and baked into bread while oil extracted from the seed is also useful for cooking (Majia, (1998). The seeds can also be processed into livestock feed while the young leaves are used in soups. It is relatively low in food value especially protein. Most of its nutrients value lies in its content of sugar and vitamins. The seeds contains about 25-32% protein, while the leaves contain vitamin A and Minerals.

Water melon is vulnerable to many pests and diseases. This constitutes the main limiting factor in its production. Bankole (1996) reported a paucity of information on pest and diseases affecting water melon when compared with other horticultural crops. The result of their experiment on the preliminary studies with melon plants shows that the associated insect pest on melon in their area of experiment, belongs to these orders mainly Coleopteran, (those feeding on leave and stems) Lepidoptera and

Hymenoptera (those feeding on flowers).The use of broad-spectrum chemical pesticides is responsible for significant damage, serious human health problems and spiraling cost of production. It is generally acknowledged that an acceptable solution to the problem of pesticide misuse must include policy change, establishment of knowledge intensive and farmer base approaches to pest management and the utilization of novel pest control techniques (Mumford and Stonehouse, 1994; Kenmore, 1996; Schillhorn Van Veen **et al**; 1997), the mentioned problems emanating from the use of synthetic chemicals makes it unsuitable for peasant agriculture. However, there is insecticide of plant origin that can be used without the problems associated with synthetic chemicals Arnason et at.(1998). Several plants are known to synthesize both primary and secondary metabolites which protect them from attack by insects and micro-organisms Jacobson (1986, Olaifa and Akingbongbe 1987.

Natural plant products are at present in the focus of research efforts because of their ability to produce less harmful but efficacious biodegradable plant protection chemicals (Schmuterrer, 1990). It is hoped that these would replace or greatly minimize the use of highly toxic synthetic insecticides Jakai **et al,** (1992).

Water melon is now gaining ground all-over the world especially in Nigeria but it is vulnerable to pest and disease attack in all the stages of production. This tends to be a limiting factor in the production of the crop. Hence there is need to guide against these limiting factors so as to realize meaningful yield and good quality crop. In Nigeria, very little research has been done on pesticides from plant sources though potential appears to be quite high. (Olaifa and Akingboungbe 1987). The study was therefore conducted to evaluate the efficacy of some materials viz **A. indica, R .cumunis E heterophylla** on the field insect pests of water melon ; compare their efficacy with that of a known synthetic insecticide (Nuvacron, Decis) and recommend the most effective plant material(s) to farmers in place of the synthetic chemicals.

Materials and Methods

The field trial was conducted at College of Agriculture, Ahmadu Bello University, Kabba Kogi State, Nigeria located in the Southern Guinea Savannah zone of Nigeria (Longitude 07° 50′ Latitude 06° 40′ with elevation of 247m). The average annual rainfall is 130 centimeteres with mean annual temperature of 28.8° to 35°C. The annual relative humidity is 81.2% while the soil type of the experimental site is sandy loam.

The plant materials utilized are **Azadirachta indica, Ricinus cumunis,** Euphorbia heterophyla, while Decis and Nuvacron were the synthetic chemicals utilized. The experimental design was randomized compete block design, each treatment was replicated four times. The cultural practices include land preparation which involves ploughing, harrowing and ridging, planting, weeding and application of ferilizer were done accordingly and at the required time.

Preparation of plant materials

One hundred grams of dried powder Neem leaf, castor leaf and **Euphorbia heterophylla** were heated seperately in one litre of water each (1000ml) at temperature of 100 C for one hour. This was allowed to settle overnight and later filtered. The extract collected serve as stock solution and was calculated to be 100,000ppm using a standard dilution equation shown below:

1mg/L = 1ppm

1000mg = 100 x 1000mg/L)ppm

100,000ppm

where mg = Milligram

L = litre

Calculation of chemical (insecticides) used per litre of water.

From the manufacturer label of both Decis and Nuvacron, 50ml of chemical was to be diluted in 20 litres of water. To calculate the dilution rate per litre of water, the following procedure was used:

50ml (insecticide = 20 of water)

1L of water = 1000ml

=20,000L of water

1m of chemical = 2000ml
400ml or 0.4L of water
2ml of chemical = 400ml = 400mlx2 =800ml of water
21/2 or 2.5ml of chemical = 1000ml of water.
= 0.8L/ha

Pesticide application

Application of treatment to **Azadirachta indica, Ricinus cumunis, Euphorbia** heterophylla, Decis and Nuvacron began two weeks after planting. This is done in the early hour of each spraying day. Each treatment was applied to its respective plot as contained in the randomized block design arrangement.

A = Decis
B = Neem
C = Nuvacron
D = **Castor leaves**
E = Control (ordinary water)
F = **Euphorbia heteropylla**

Insect count was carried out the second and third day after treatment application. This involved counting the insect pests that were alive in each of the plots and number recorded.

The processes were continued till the end of the spraying period.

Flowering count

This started when the first flower appeared and it continued until flowers were recorded in all the plots. Both the number of days it took each plot to flower and the number of observed flowers were recorded.

Branch count- This started at the first appearance of branches on the main vein till harvesting period.

Data analysis

All data collected in the two years were subjected to analysis of variance (ANOVA) and the results were used for the interpretation of findings.

Observed insect pests

The insect pests observed in the experimental site are:
Podagrica sjostedti
Asbececta nigricps
Aulacophora africana
Leaf miners (Tetranychus spp)
Cynipennis spp

Results

Effects of Some Materials and Synthetic Chemicals on the Growth of Water Melon :

The growth parameter was based on the average number of branches and height at flowering. Various treatments brought about significant differences in the height as well as number of branches recorded per treatment. Nuvacron and Decis treated plots were superior to the other treatments with respect to the parameters tested. Neem treated plots had the highest height as well as the largest number of branches among the plant materials. Different treatment brought about significant differences in the growth of the water melon. (Table 1).

Effects of Some Plant Materials and Synthetic Chemicals on the Flowering rate of Water Melon.

Table 2 is the analysis of variance on the number of flowering produced per plant after treatment application. There was no significant difference in the number of flowers despite the variation in treatment application. All the treatments were not significantly different from the control with respect to this parameter (Table 3).

Effect of various Treatment on Insect Population

There was a significant difference among the various treatments. Nuvacron and Decis treated plot had the least average number of insects and they are significantly different from the other plant treatment and control. (Table 3)

Effect of Various Treatment on the Yield of Water Melon

There was a significant difference in both the fruit number as well as the weight, among the different treatments. Synthetic chemicals (Decis and Nuvacron) are superior to other plant materials with respect to the parameters tested in both the first and the second year of the experimentation. Neem was superior to other plant treatments and it was significantly different from other while the other plant treatments were not significantly different from the control in the year of experimentation (Table 4)

Decis treated plot had the highest yield of 15,291.64kg/ha followed by Nuvacron treated plot with a yield of 12.044.44kg/ha . Neem treated plot yielded 7.472.22kg/ha while **Euphorbia heterophylla** treated plots yielded 1.138.89kg/ha and **Ricinus cumunis** plots had a yield of 1.055.56kg/ha. The untreated control yielded 275kg/ha.

Discussion

The synthetic chemicals treated plots (Decis and Nuvacron) outperformed every other treatment in terms of the number of branches as well as height which were the two growth parameters utilized. This synthetic chemical treated plots were significantly different from every other treatments with respect to the tested parameters except the second year of experimentation where neem treated plots were not significantly different from the synthetic chemical treated plots with respect to the tested parameter (Table 1).

There was no significant difference in the number of flowers produced between the synthetics chemicals, other plant materials used and the control in the first year of experimentation but significant differences were observed between the other treatments and the control in the second year. However most of the flowers produced in the plots treated with plant materials and control, dropped before fruits were set probably because of pest infestation.

Synthetic chemicals (Decis and Novacron) were superior to other plant treatments in suppressing insect pest activity which in return enhanced the growth of water melon as observed in Table 1. The effectiveness of the synthetic chemicals above other plant extracts has been reported by Ivbijaro and Bolaji (1990) Jackai **et al.** (1992). Abolusoro (2000) also reported the superiority of synthetic chemicals over other plant materials.

There was a significant difference in the population of insects' sample in the synthetic chemicals treated plots and other plots. Decis treated plots had the least number of insects followed by Nuvacron treated plots and they were significantly different from the plant material treatment plots and the control. This observation agrees with that of Ivbijaro and Bolaji (1988) Jackai **et al**. (1992) and Abolusoro (2000) who reported effectiveness of synthetic chemicals over plant materials in their various experiments. The yield parameter was based on number of fruits and yield in kg/ha. The synthetic chemical treated plot outperformed every other treatment and was significantly different from them.

Decis treated plots had the highest yield followed by Nuvacron plots. Neem treated plots outperformed every other plant material treatments and was significantly different from all the other plant materials and the control. However the number of insects counted in the neem treated plots were high and not significantly different from other plant materials and the control but had a higher yield than other plant materials. This probably proves that the insect observed in neem treated plots could not feed much because of the presence of Antifeedant material, (Azadirachtin) present in neem. This material prevents the insect from feeding. The insects therefore starve to death or they ran away. Their presence does not necessarily prove that they are capable of totally suppressing the plant. This observation agrees with Schmulterer (1990) who reported inhibition of some field insects on pest action by neem derivatives (Azacdiratin) which prevents feeding on the host by insect pests hence damage are reduced. The yield 15,291 t/ha realized in Decis treated plot is considered realistic since it agrees with F.A.O. (1988) that reported a yield of 15-20 t/ha depending on the varieties.

Table 1: Effects of Some Plant Materials and Synthetic chemicals on the growth of Water Melon.

TREATMENT	AVERAGE NUMBER OF BRANCH		AVERAGE HEIGHT AT FLOWERING	
CHEMICAL AND PLANT MATERIALS	YEAR		YEAR	
	2000	2001	2000	2001
Decis (A)	7.9ab	8.2a	0.829	0.88a
Neem leaf (B)	6.8b	6.5b	0.76ab	0.80a
Nuvacron (C)	9.1a	9.9a	0.88a	0.92a
Ricinus cumunis (D)	5.1c	6.20b	0.55c	0.56c
Control (E)	4.9c	4.10c	0.56c	0.50c
Euphorbia heterophylla F	6.6b	6.77b	0.70b	0.68b

Same letter after figure in a column between means denote lack of significant differences according to Turkey test at p = 0.05.

Table 2: Effects of some Plant Materials and Synthetic chemicals on the Flowering rates of Water Melon.

	YEAR	
	2000	2001
Decis (A)	8.0a	9.3a
Neem leaf (B)	8a	8.8a
Nuvacron (C)	8a	10a
Ricinus cumunis (D)	7.8ab	8.03a
Control (E)	7.5ab	6.9b
Euphorbia heterophylla leaf (F)	8.3a	8.8a

Same letter after figure in a column between means denotes lack of significant difference according to Turkey test at p = 0.05.

Table 3: Effects of Some Plant Materials and Synthetic Chemicals on the Insect Population

TREATMENT CHEMICAL AND PLANT MATERIALS	AVERAGE NUMBER OF INSECT	
	YEAR	
	2000	2001
Decis (A)	2.28c	2.96[5]
Neem leaf (B)	13.85a	13.02a
Nuvacron (C)	6.39b	5.80b
Ricinus cumunis (D)	14.60a	14.00a
Control (E)	13.46a	15.03a
Euphorbia heterophylla (F)	14.53a	13.47a

Same letter after figure in a column between means denote lack of significant differences at P = 0.05.

Table 4: Effects of Some Plant Materials and Synthetic Chemicals on the Yield of Water Melon

TREATMENT PLANT MATERIALS/CHEMICALS	AVERAGE NUMBER OF FRUIT		AVERAGE WEIGHT OF WATER MELON	
	YEAR		YEAR	
Decis (A)	3ab	4.3a	13.76a	13.68a
Neem leaf (B)	2.bb	3.2ab	6.72b	9.89b
Nuvacron (C)	4.8a	5.1a	10.84ab	11.13a
Ricinus cumunis (D)	1c	0.9c	0.95c	1.00c
Control E	0.8c	0.7c	0.24c	0.35c
Euphorbia heterophylla F	1c	1.3c	1.02c	1.09c

Same letter after figure in a column between means denotes lack of significant differences according to Turkey test at P = 0.05.

Conclusion

Results of this experiment show that synthetic chemicals are superior over plant materials for the control of field insect pests of watermelon. Decis outperformed Nuvacron with respect to all the parameters tested. Neem was superior to other plant materials that were investigated, however, the yield from neem-treated plot was abysmally lower than the synthetic chemicals treated plots but better than any other plant chemicals. (Decis and Nuvacron) are capable of controlling field insect pests of water melon. Where this chemicals are not available for any reason, neem should be used but such farmer should not expect reasonable yield. **Ricinus cumunis, Euphoribia heterophylla** extracts are however not effective in the control measure.

Recommendation

Based on the findings, synthetic chemicals is recommended for all the farmers operating in this geographical region: If however neem is to be used, the concentration may be increased to 200,000ppm but it should be subjected to experimentation so as to detect any possible phytotoxicity on the plant.

It is therefore recommended that further investigation should be carried out raising the concentration of all the plant materials to about 200,000ppm or above to determine their efficiency. The result from this will guide us in recommending the said materials for pest control. Neem is readily availlable in Kogi state like other Savannah region of Nigeria and farmers can get this plant at no cost, the leaves as well as the fruits are edible hence man does not stand the risk of been poisoned when he feeds on food crop treated with this plant. Neem is highly available in Kogi State.

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