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Research Article

The effects of water deficit on the susceptibility of cashew seedlings foliage to attack by the red banded thrips-*Soleno thrip Rubrocinctus* –Giard

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Abstract

To determine the level of water deficit favoring the attack of pests (Red banded thrips) in cashew seedlings foliages, cashew seeds were germinated and raised to saplings (50-60cm) in polythene bags in a nursery. Sixteen vigorous seedlings were selected and transferred to a screen house and formed into four treatments as follows. Control (A) mild water deficit, (B) severe water deficit, (C) more severe water deficit (D) using densitometers to record the water deficit levels of each group. These seedlings were subjected to water deficit levels of 60 centibars (cb) 70 centibars (cb), and 80 centibars (cb), respectively by the trial and error method. Plants heights (cm), number of leave and transpiration rates of each group were assessed in six weeks and 2 experiments to determine the choice of the red banded thrips on the leaves from these treatment groups were carried out using 4 leaves decapitated at random from each treatment and exposing them to these insects in enclosed clear plastic boxes. Plant height, number of leaves, water loss (transpiration) were shown to be significantly different between the treatments were observed. The results of the experiment conducted have shown that the insect clearly choose leaves from control and mild water deficit more than they did severe and more severe water deficited leaves.

Keywords: water deficit, cashew seedlings, growth parameters, Red banded thrips, pest

INTRODUCTION

Plants generally require water for all their physiological activities. Water deficiencies lead, under less extreme conditions, to growth inhibition by lack of nutrients and reduce energy assimilation and under more extreme conditions to loss of turgidity, susceptibility to pest and diseases attacks and eventual wilting of the plant. Cashew seedlings are affected by such water deficiencies with the resultant infestation of pests. Cashew (*Anacardium occidentale*) belongs to the (family *Anacadiceace*). It is an important evergreen, woody and dicotyledonous fruit tree with a tap root system. It originated from Eastern Brazil from where it spreads to central and Eastern America and later to other parts of the world including temperate and tropical zones (Adams *et al.,* 2000). The fruits is kidney shaped achene which contains fat soluble vitamins A, D, E and K, considerable calcium, phosphorus and iron in organic complexes, protein (20-22%), linolenic acid (which prevent high levels of cholesterol and coronary diseases) and fat (8-82% unsaturated fatty acid which prevents the development of fatty liver). The apple is sweet when ripe and its juice consists of vitamin C, reducing sugars (7-9%), soluble solids (11-12%) and tannic acid (0.5%) (Funderburk and Olson, 2000).

The annual production of cashew nut (where it is the main commercial product) is well above 250,000 tones and more than 50% comes from Africa and south Asia. The plant is being attacked by many pests especially at seedling stage e.g.

the red banded thrips, white flies, Power beetles, moths and locust. Control is by chemicals (e.g rogor or Gamnalin 20) or by removal of affected plants (Ahmed, 2014; Chant and Loresto, 1986). Cashew nut is recently becoming an important commercial product in Nigeria. Government is at recent times establishing plantations of Cashew and has already embarked on sensitizing farmers especially small scale farmers on its cultivation. However, serious infestation threat of pests especially the red banded thrips poses great challenges in its cultivation. Experimental evidence on information of these pests on this important plant in relation to water deficit is lacking. This therefore does not only justify the study but could help in avoiding the toxic. Influence of deposited chemical in the Fruits of (tic plant, on consumption by humans.

The objective of this research was to determine the water deficit level (s) favoring the choice of leaves by the red banded thrips.

MATERIAL AND METHODS

This research was conducted at the Tree seedlings Nursery and Screen house of the Faculty of Agriculture, Bayero University, Kano (latitude $11^{0}58^{1}$N, longitude $8°25^{1}$E^{1} 8025 and elevation 457m above sea level).

Treatment and experimental design

Four treatment groups as Follows: Control (A), Mild water deficit (B), severe water deficit (C) and more severe water deficit (D). Seed Source: The seed were sourced from the National Institute of Horticultural Research (NIHORT) Bagauda, Kano-State.

1. Seed treatment and Sowing: River sand Soil and well decomposed manure (cattle dung) were thoroughly mixed in a 3: 1 ratio and filled into 4 big sized polyethylene bags (pots). These were arranged under a tree shade and then watered for two days prior to sowing. The seeds were then sown with the lobed portion facing downwards.
2. Seed germination and seedlings management: seed germinated after

12 days while watering and other management practices such as removal of weed etc were continued until the sapling were 50-60cm in size after which 16 seedlings were selected for the experimentation.

Creation of Water Deficit level

The following groups were cr(N1cd 1l1(1 established as follows:

- Control (A)
- Mild water deficit (B)
- Severe water deficit (C)
- More severe water deficit (D)

And four seedlings were selected in each group. Sixty (60cm) tensiometers were buried 15cm deep in the four seedlings pots in each of the four treatments (A, B, C and D). The tensiometers were used to measure the soil moisture content in the pots (0-100 centibars at wet dry soil condition) higher reading indicating a drier soil. All the seedlings were watered to initiate the experiment. The tensiometers were monitored daily to determine when the seedlings in each treatment entered the desired range of water deficit control seedlings were maintained in saturated soil by watering frequently. The watering regime for the water deficit treatment was established by trial and error, but it involved adding between 150 250 ml of water as follows:

Mild water deficit every other day, severe water deficit every 3 days and more severe deficit every 5 days

Collection of Adult Insects

Adult red banded thrips were manually collected on the day of the experiment on infected leaves in the mild at Maje Cashew Plantation Bebeji local government area, Kano State, in closed but well ventilated container.

Experiment Design

Having established the water deficit levels in the treatment plants, the experiment was designed as follows:

Two clear Plastic boxes (47x31x21cm) were purchased from Kofar Wambai, Kano City. On the experiment day, the bottoms of these boxes were lined with toilet tissue papers, and their sides and lids were punched with holes to facilitate air circulation.

First Experiment

In the late evening, four leaves from each treatment group (control mild water deficit, severe and more severe deficit groups) were decapitated at random, weighed and recorded, and except the leaves from control plants. All leaves were supplemented with water through the petioles for about an hour. The tissue at the bottom of the box was moistened with water arid placed cit each corner of the clear plastic boxes. That is, one leaf from each treatment group was placed at each corner of the clear plastic box. Twenty Adult red banded thrips were placed at the centre of the clear plastic box and the lid was closed and the hoc was left till the following morning when the box was opened magnifying glass was used to observe the presence of the red handed thrips on each leaf at cacti comes and recorded.

Second experiment

The second experiment was conducted in the second clear plastic box which was also lined with tissue paper which was moistened with water. Four leaves from each treatment were decapitated and the leaves were placed into the clear plastic box without water supplementation. Forty (40) Adult red banded thrips were placed at tile centre of the clear plastic box (the insects' number was increased to 40 to have a clear cut picture of the insects' choice of leaves). The lid and sides of the box were also punched with the holes to enhance the air circulation in the box. The lid was then closed and allowed to stand till the Following morning the box was opened to record the presence of the insects on the leaves from the corners of the box.

DATA COLLECTION

Data on plant height and number of leaves were collected at 2 weeks interval in the screen house. Data on adult insects' choice of leaves was obtained by simple counting of number of insects on each leaf in the clear plastic boxes.

Data Analysis

The Data collected (i.e the number of leaves and plant height) was analyzed using analysis of variance (ANOVA) and (Duncan multiple range test) DMRT.

Metrological Data

The mean monthly Data on temperature, sunshine intensity, relative humidity etc covering the research period were obtained from the technology station of the institute of Agriculture research, Kano.

Table 1. Effects of water deficit on the plant height (cm) of cashew seedling subjected to water deficit

Treatment	Initial measurement	2 weeks	4 weeks	6 weeks
0 centibar	45.75a	49.65a	53.90a	64.55a
60 centibar	45.63a	49.40ab	52.28a	60.88b
70 centibar	44.38a	47.05ab	49.13b	52.80c
80 centibar	44.00a	46.35ab	48.50b	51.00d
LSD	2.722	3.1604	2.3673	0.9746

Means followed with the same letter (s) in columns are not significantly different at 5% level of probability using DMRT

Table 2. Effects of water deficit on the number of leaves of cashew seedling subjected to water deficit

Treatment	Initial measurement	2 weeks	4 weeks	6 weeks
0 centibar	14.75a	18.25a	22.25a	27.50a
60 centibar	14.50a	17.75a	21.25ab	25.50b
70 centibar	14.40a	17.00a	20.00b	22.50c
80 centibar	14.50a	16.25a	19.50b	20.50d
LSD	0.5655	2.4484	2.1983	1.2504

Means followed with the same letter (s) in columns are not significantly different at 5% level of probability using DMRT

Table 3. Correlation between the number of leaves and plant height (cm) of water treated cashew plants

	Height	Leaves
Height	1.000000	0.94738
Leaves	0.94738	1.00000
	< 0001	<0001

Table 4. Weight loss (g) in leaves removed from water deficit treated plants before and after supplementing in water

Treatment	Initial weight	Final weight	Weight difference
A (Control)	8.0	7.5	0.5
B (60cb)	7.3	7.0	0.3
C (70cb)	7.1	6.9	0.2
D (80cb)	6.3	6.2	0.1

Table 5. Population of Red banded Thrips on leaves removed from cashew seedlings as affected by water deficit and water supplementation

Water treatment levels	Water treatment levels	Non- supplemented
0cb	5	7
60cb	5	7
70cb	6	3
80cb	4	3

RESULTS AND DISCUSSION

The results obtained on plant height (Table 1) had indicated little or no difference in plant height between the water treatment levels except with control treatment (0 cb). Similarly, although the number of leaves consistently decreases with water treatment levels but there was no significant difference in the number of leaves of the various treatment levels (Table 2). These results have corresponded with the report of Grunzweig and Korner (2001) that plant growth generally reduced under moisture deficit. In this experiment, the greatest decrease in growth was observed in plants treated with 70cb and 80cb compared with control. The decrease in plant height was probably due to growth inhibition as a consequence of adequate nutrients and energy assimilation. This is at par with the report of Ozawa (1989) who showed that decrease in seedling growth implicated by water deficit may have been due to the stage of growth, their root volumes and water availability.

The results of the insect count (population) as affected by water deficit are shown in table 3. From the results, it appeared that in the water supplemented leaves, five red-banded thrips were found on 0cb and 60cb each while six were found on 70cb and 80cb each. However, in the non supplemented leaves, seven red banded thrips were recorded on each of 0cb and 60cb and three on each 70cb and 80cb (Table 6)

The red banded thrips clearly fed selectively on only leaves in the unsupplemented experiment i.e. preferred those that were grown under turgid conditions which were the control and mild water deficit. This suggested that water deficit affected the chemistry of the water deficit foliages and therefore it remains most likely that foliage choice by the adult red banded thrips can be associated with water deficit and for infestation due to the improvement of the nutritional quality of the leaves through increased available nitrogen and hence increment of early lave survival of the thrps (White, 1984). The findings in this research is similar to the findings of Shu'aibu *et al*. (2013) in their research on the Preference of food Plants by Adult of the Desert Locust *Schistocerca gregaria* where they found that the adult locust preferred succulent leave to flaccid or non turgid leaves of cotton and cowpea. Earlier on, Fukutoti and Yamada (1981a and b), Tuner and Jones (1980) considered the chemical and physical conditions in foliages that accompany water deficit as possible causes affecting herbivorous insects. The results of this experiment have clearly pointed to the physical changes in foliages experiencing water deficit as an obstacle to feeding insects especially the sucking insects. The avoidance of foliage grown under water deficit by red banded thrips is consistent with the power performances on similar foliage noticed by White (1984).

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Appendix: Metrological data of Kano at 2007

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Tem (OC per Day)	28	36	38	43	39	34	32	31	32	37	36	32
Minimum Tem (OC per Day)	14	17	20	25	26	22	22	21	21	19	17	15
Relative Humidity % (per day)	44	20	29	51	61	69	75	80	75	49	30	32
Earth Temp 0C (30cm per day)												
Earth Temp 0C (120cm per day)												
Evaporation water tank (mm) per day	7.9	8.3	9.9	9.3	7.4	4.5	4.3	2.4	4.2	6.4	7.1	6.6
Wind run (km per day)	10199	78.99	73.35	93.26	102.26	119.71	101.39	62.51	155.24	49.86	48.53	54.10
Rainfall total mm	0.0	0.0	0.0	16.7	60.8	224.4	165.7	309.4	41.0	0.0	0.0	0.0
Sunshine (HR) per day	6.7	9.3	7.6	11.2	7.2	2.1	6.9		6.4	8.9		

Source: Institute of Agricultural Research, Kano.