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The Performance of Two Varieties of Garden Egg (*Solanum melongena* L.) as Influenced by Weed Control Methods in Southeastern Nigeria

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Abstract: The experiment was conducted between May and September, 2019 at the Teaching and Research Farm Choba, Port Harcourt, Rivers State, Nigeria, with the aim to determine the effect of weed control methods on garden egg. The experimental design was a 2 x 4 factorial scheme laid in a randomized complete block design (RCBD) with 8 treatments combination replicated three times. The treatment used for the experiment were: two varieties of garden egg (Bello and Yalo) and three weed control methods i.e. Pendimethalin (Force Top®) at a recommended rate of 4 L/ha, dead mulch (sawdust at 10 t/ha), weeding twice at 3 and 7 weeks after transplanting (WAT) and no weeding check. Weed parameters determined were weed density, weed dry weight and weed index. The crop parameters determined were: plant height, leaf area index, number of fruits and fruits yield. In addition, economics analysis on the various weed control method were carried out. Results showed that variety Bello was better than Yalo in terms of weeds suppression and crop performance. Among the weed control methods, weed suppression and crop performance was better in weeded twice plot closely followed by Force Top® at 4L/ha. The best interaction effect on weed suppression and garden egg performance was on a combination of variety Bello with weeding twice and this was closely followed by variety Bello with Force Top® at 4L/ha. Also, the economic analysis showed that the most profitable weed control method was Force Top® at 4 L/ha for both varieties, variety Yalo gave a profit of US$17998.18 while variety Bello gave US$30295.04. Since variety Bello gave the highest economic return when weeds were controlled using Force Top® at 4L/ha, it is thus recommended to farmers in the area of study or region with identical geographical location.

Key words: Garden Eggs · Varieties · Weed Control Methods · Performance · Economic Analysis

INTRODUCTION

Garden egg (*Solanum melongena* L.) and other vegetables such as Irish potato, tomatoes and pepper, belong to the same family of Solanaceae. The fruit is grown in nearly all states of Nigeria but it is commonly grown in the eastern region of Nigeria which comprises of Anambra. Abia, Enugu, Imo, Ebonyi, Akwa Ibom, Cross river state and Rivers states. Locally it is called by various names by different ethnic groups in Nigeria. In the eastern states, the Ibos called it 'Anara', Western states, the Yorubas called it 'Igbagba' while in the northern states it is known as "Yalo" by the Hausas [1]. The vegetable is becoming an alternative for kola nut because of the high caffeine content present in kola nut (*Cola acuminata* and *C. nitida*).

In Nigeria, it is traditionally used in various functions such as marriages, baby naming/dedication and new yam festivals. It also serves along with fried groundnut during academic seminars/ conferences and workshops. In most localities, it is used to welcome strangers or visitors. Almost all parts of garden eggs are useful. The roots are used in traditional medicine to treat bronchitis, asthma, wounds, abdominal worms, diabetes and stomach disorders [2]. Anosike *et al.* [3] observed that the leaves of eggplant are used to cure boils, stomach and throat pains.

Despite the high economic importance of garden egg, the yield, in Nigeria is generally low due to the use of lack of a suitable variety without a broad genetic base coupled with inappropriate weed control methods. A good crop variety that has good canopy coverage intercepts with

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light penetration and prevents weed growth or suppresses the growth of weeds as a result of no photosynthesis. When weeds are adequately controlled, the growth and yield of crops are enhanced

However, the information in the literature on the use of different crop varieties for controlling weeds in garden eggs is scanty. Since controlling weeds with one method is inadequate it is imperative to combine the use of suitable variety and weed control methods for effective weed control and better performance of garden egg in an integral manner. Therefore, the objective of this study was to determine the effect of different weed control methods on the growth and yield of the two varieties of garden egg in southeastern Nigeria.

MATERIALS AND METHODS

Experimental Site: The field experiment was conducted at the Faculty of Agriculture Teaching and Research Farm of the University of Port Harcourt, Nigeria between May and September early cropping season in a humid forest Agro-Ecology with latitude 04°54' 538'N and longitude 006°55' 329'E with an elevation of 17 meters above sea level. The area has an average temperature of 27°C, relative humidity of 78% and average rainfall that ranges from 2500-4000 mm [4]. The area had distinct wet and dry seasons. The wet season has double rainfall peaks. There are two cropping season early March to July and late August to December. The experimental site was left fallow for five years before the commencement of the study. The vegetation was dominated by weeds such as Aspilia *africana*, *Cyperus spp. Panicum maximum*.

Soil Analysis: Before the experimentation, representative soil samples were taken randomly from the experimental plot at a uniform depth of 0-15 cm with an auger for physico-chemical properties. These properties were determined by standard laboratory procedures.

Source of Planting Material: Garden egg seeds were bought from the Agritropic office at the oil mill in Port Harcourt in Rivers State.

Mulching material Used: The mulching material i.e. sawdust was obtained from a sawmill within the University Port Harcourt axis at Choba.

Herbicide Used: Pendimethalin (Force Top®) herbicide was used for the study. The herbicide was obtained from an Agrochemical store in Ibadan, Oyo State, Nigeria.

Treatments, Experimental Design: The experimental design was a 2 x 4 factorial scheme laid in a randomized complete block design (RCBD) with 8 treatments combination replicated three times. The treatment used for the experiment were: two varieties of garden egg (Bello and Yalo) and three weed control methods i.e. Pendimethalin (Force Top®) at the rate of 4 L/ha, dead mulch (sawdust at 10 t/ha), weeding twice at 3 and 7 weeks after transplanting (WAT) and no weeding check.

Cultural Practices

Nursery: The seed pans with perforated holes were filled with topsoil and were put under the shade close to the experimental area. The pans were filled with water and allow to drain for three days below field capacity. After that, the seeds were sowed in the pans on 1st May 2019 and covered with soil. The pans were water in every alternate day with 200 ml of water for six (6) weeks before being transplanted into each plot.

Land Preparation: The experimental area occupied a land dimension of 33m x 12m (396 m^2) which was approximately 0.04 ha. The experimental area was manually cleared using cutlass and the debris was packed before marking out into three (3) blocks of eight (8) plots each. The plot size was 3 m x 3 m. Plots and blocks were separated with an alleyway of 1 m each. Plots that have herbicide labels were sprayed with CP3 knapsack sprayer, calibrated to deliver 250 L/ha at a pressure of 210 kpa of the spray solution using a red polijet nozzle of swath width of 0.5 m. Ten (10 t/ha) of dry sawdust was weighed with a spring balance fixed to horizontal bar supported by forks sticks were uniformly spread on the appropriate treatment plots immediately before transplanting.

The garden egg seedlings were transplanted in the early morning of 14th June, 2019, using one seedling per hole at a spacing of 0.5 × 0.5 m for each plot in the experimental area. The plant population per plot in each treatment was 36 plants which was equivalent to 40,000 plants /ha. Some plots were manually weeded at 3 and 7 weeks after transplanting (WAT). The basal application of urea fertilizer at 2.5 kg/ha was applied to each plot at 4WAT to boost the nutrient status of the soil.

Data Collection

Weed Growth Characteristics

Weed Density and Weed Dry Weight: Weed density was determined by placing two quadrates of 0.5 x 0.5 m size diagonally per plot at 3 WAT, 6 WAT and 9 WAT. The weeds were harvested from each quadrat and

counted and expressed in no/m^2. The weeds obtained from each quadrat per plot at 3 WAT, 6 WAT and 9 WAT were washed with water especially the roots to remove the attached soil. The weeds were oven-dried at 70°C for 72 h weighed and expressed in g/ m^2

Weed Index (WI): Weed index was determined by the below equation

$$\text{Weed index} = \frac{\textit{yield from weed free check} - \textit{yield from treated plot}}{\textit{yield from the weed free check}} \times 100 \quad [5]$$

Garden Growth, Yield and Yield Component: A sample of three plants was taken at random from the inner rows of each experimental unit to measure the following garden egg parameters:

Leaf Area Index: The leaf area index was calculated by dividing the total leaf area per plot and by the gross plot occupied by the plant.

Number of Fruits: This was done by the physical counting of mature fruits at weekly intervals per plot for three harvests.

Fruit Yield (kg/ha): The two varieties were harvested at maturity. Harvesting of Bello variety commenced from 19th August to 31st 2019 (10WAT, 11WAT and 12WAT) while that of Yalo variety commenced from 25th August 2019 to 6th September, 2019 (11WAT, 12 WAT and 13 WAT). The fruits were handpicked at every weekly interval from the 3 tagged plants. A total of 3 harvests was carried before the termination of the experiment. The fruits were weighed with an electronic scale and their averages were taken as weight per plant. The average weight per plant was converted to kilograms per hectare by multiplying by the plant population of 40,000 and thereafter the cumulative average fruit weight per plant for the 3 harvests were subjected to statistical analysis.

Statistical Analysis: Data generated from the experiment were subjected to analysis of variance (ANOVA) using GEN STAT [6] procedures and means were separated using the least significant difference (LSD) at 5%.

Economic Analysis: Economic analysis was done by using partial budgeting by Okoruwa *et al*. [7] for the economic evaluation of the different weed control methods of the garden egg by using the mathematical expression of GM = TR – VC, TR = (Y_G x P_G), VC = M x L, Where; GM = Gross margin/ha, TR = Total revenue (US Dollar), VC = Variable cost (US Dollar), Y_G = Garden egg yield (Kg/ha) for each Treatment, P_G = Price of garden egg per Kg, M = Value of material input (seeds, fertilizers, Force Top®), L = Value of labor (land preparations, planting, Force Top® application, harvesting, transportation).

RESULTS AND DISCUSSION

Soil Test: The physicochemical properties of the soil in the experimental site are presented in Table 1. The basal dose application of urea fertilizer was applied to each treatment because the result from the soil analysis revealed that the nitrogen level of the soil was low (0.10%) as compared to its critical value [8]. However, the organic carbon (Oc), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) were adequate [8].

Weed Growth Characteristics

Weed Density: The effect of weed control methods on weed density of two varieties of garden egg is presented in Table 2. At 3WAT, there were no significant differences between the varieties. However, weed density was lower in variety Bello than in Yalo. The weed control methods differed significantly ($P < 0.05$) for weed density. The weedy plots and twice hoe weeded plots had the highest weed density when compared to other weed control methods. The Interaction effects of variety and weed control methods were significant ($P < 0.05$). The highest interaction value was obtained in control (no weeding) and twice hoe weeded plots in both varieties when compared with others.

At 6 WAT there were no significant differences between the varieties while significant differences ($P < 0.05$) existed between the weed control methods and their interaction. The highest weed density was recorded in weedy plots while the lowest in plots hoe weeded twice and plots treated with Force Top®. The highest interaction was obtained from the control plots while the lowest from the weeding twice plots.

At 9 WAT, there were no significant differences between the varieties but there were significant ($P < 0.05$) differences between weed control methods and their interaction. The highest weed density was obtained from no weeding plot and the lowest weed density was obtained from weeding twice plot. In interactions, the highest value for weed density was obtained from a combination of no weeding with variety Yalo while the least was from weeding twice plot combined with variety Bello.

Table 1: Physico-chemical properties of the experimental site before planting

Soil Properties	Value
Physical Properties	
Sand (%)	81
Silt (%)	3
Clay (%)	16
Textural Class	Loamy sand
Chemical Properties	
pH (H_2O)	5.6
Total Organic Carbon (%)	1.15
Total Nitrogen (%)	0.10
Available P (mg/kg)	16
Cation Exchangeable Capacity (cmol/kg)	
Ca	3.13
Mg	3.02
Na	1.34
K	3.03

Table 2: Effect of weed control methods on weed density (no/m^2) of two varieties of garden egg

		Weed control method (WCM)				
Weeks after Transplanting	Variety (V)	Force Top®	Sawdust	Weeding twice	No weeding	Variety mean
3	Yalo	53.0	65.7	94	95	76.93
	Bello	50.0	60.3	93	94	74.33
	WCM mean	51.5	63.0	93.5	94.5	
	LSD (0.05)					
	V =		4.38			
	WCM =		6.19			
	VxWCM =		8.75			
6	Yalo	51.3	79.3	46.7	112.7	72.5
	Bello	46.3	71.0	40.7	110.3	67.1
	WCM mean	48.8	75.2	43.7	111.5	
	LSD (0.05)					
	V =		13.29			
	WCM =		18.79			
	VxWCM =		26.57			
9	Yalo =	80.3	115.0	63.7	152.7	102.9
	Bello =	64.3	98.0	36.7	143.3	85.6
	WCM mean	72.3	106.5	50.2	148.0	
	LSD (0.05)					
	V =		17.83			
	WCM =		25.22			
	VxWCM =		35.67			

Throughout the sampling interval, non-significant differences were noticed between the varieties of garden eggs on weed density. However, variety Bello tended to have lower weed density than Yalo probably due to its broad genetic base. It looks more robust with good canopy formation which enables it to shade out the light from the soil surface that could have activated the weed to stimulate growth judging from its greater leaf area index. The use of crop varieties in shading out weeds had been reported by several authors in the past studies of crops such as rice and sesame [9, 10].

Among the weed control methods plots that were weeded twice had the lowest weed density throughout the observations period except at 3 WAT. At 3 WAT, the plots were not weeded before data collection and were found statistically similar to weeding check. The herbicide treated plots have lower weed density when compared to sawdust plots probably because of the potent nature of the active ingredient that makes to be phytotoxic. The high weed density in sawdust might be attributed to its light nature. Rainfall might have removed some of the particles away from the plot through water

Table 3: Effect of weed control methods on weed dry weight (g/m^2) of two varieties of garden egg

		Weed control method (WCM)				
Weeks after Transplanting	Variety (V)	Force Top®	Sawdust	Weeding twice	No weeding	Variety mean
3	Yalo	38.3	54.5	61.1	62.5	54.1
	Bello	33.2	54.7	60.7	60.5	52.28
	WCM mean	35.8	54.6	61.0	61.5	
	LSD (0.05)					
	V =		19.67			
	WCM =		27.81			
	VxWCM =		39.34			
6	Yalo	25.8	50.1	16.6	92.4	46.2
	Bello	20.8	46.7	12.3	91.7	42.9
	WCM mean	23.3	48.4	14.5	92.0	
	LSD (0.05)					
	V =		5.40			
	WCM =		7.61			
	VxWCM =		10.81			
9	Yalo =	28.2	29.2	26.3	75.5	39.8
	Bello =	30.3	38.1	26.9	78.7	43.5
	WCM mean	29.2	33.6	26.6	77.1	
	LSD (0.05)					
	V =		13.49			
	WCM =		19.09			
	VxWCM =		26.99			

erosion or could also be due to wind erosion making to have fair coverage that allows light to penetrate the soil surface to stimulate weed germination and growth. The weedy had the highest weed density probably as a result of lack of weed control. The weedy plots were exposed to light which stimulated weed growth.

Weed Dry Weight: The effect of weed control methods on weed dry weight of two varieties of garden egg is presented in Table 3. There were no significant differences among the weed control methods, between varieties but their interaction was significant ($P< 0.05$). In interaction, the highest weed dry weight was obtained in no weeding plot and twice hoe weeded plots under both varieties while the lowest were in plots weeded twice and plots treated with Force Top®) under both varieties. At 6 WAT, there were no significant differences between the varieties however, the weed control methods and their interaction differ significantly ($P < 0.05$). Among the weed control methods, the highest weed dry weight was in weedy plots while the lowest was in plots hoe weeded twice. In interactions, no weeding plots had the highest weed dry weight while hoe weeded twice plots had the lowest with both varieties.

At 9 WAT, there were no significant differences between varieties, however, significant ($P <0.05$) differences were observed between weed control methods and their interaction. Plots hoe weeded twice had the lowest weed dry weight but it was statistically at *par* with the plots treated with Force Top® and plots treated with sawdust. In the interaction effects, the highest weed dry weight was recorded in no weeding plots under both varieties while the lowest in hoe weeded plots under both varieties.

The high weed dry recorded in the weedy plots in all the samplings intervals could be attributed to no weed control with this treatment. Plots hoe weeded twice or treated with Force Top® had a lower weed dry weight probably as a result of their effective and efficient weed control. Past studies revealed low weed dry weight in crops (maize and okra) due to herbicide application [11-13].

Garden Egg Performance

Plant Height: The effect of weed control methods on plant height of two varieties of garden egg is presented in Table 4. At 3 WAT, there were no significant differences between the varieties of garden egg but weed control methods and their interaction differed significantly ($P< 0.05$) for plant height. Among the weed control methods, plants in plots treated with Force top®) grew than other weed control methods. In interaction effects, plots treated with Force Top®) grew taller under Belo variety when compared to other treatments combination. At 6 WAT, there were significant ($P < 0.05$) differences in varieties, weed control methods and their

Table 4: Effect of weed control methods on plant height (cm) of two varieties of garden egg

	Weed control method (WCM)					
Weeks after Transplanting	Variety (V)	Force Top®	Sawdust	Weeding twice	No weeding	Variety mean
3	Yalo	10.80	9.43	8.17	8.15	9.14
	Bello	15.06	12.84	10.95	11.32	12.54
	WCM mean	12.93	11.14	9.56	9.73	
	LSD (0.05)					
	V =		4.01			
	WCM =		0.64			
	VxWCM =		4.73			
6	Yalo	14.23	12.15	15.74	10.45	13.14
	Bello	21.46	18.34	23.45	15.28	19.63
	WCM mean	17.85	15.24	19.60	12.86	
	LSD (0.05)					
	V =		2.68			
	WCM =		3.79			
	VxWCM =		5.36			
9	Yalo =	28.16	27.17	31.12	22.76	27.30
	Bello =	34.18	32.72	40.48	29.63	34.25
	WCM mean	31.17	29.94	35.80	26.19	
	LSD (0.05)					
	V =		4.011			
	WCM =		5.683			
	VxWCM =		8.037			

interaction. Variety Belo plants grew taller than variety Yalo. Among the weed control methods, taller plants were observed in plots hoe weeded twice and Force Top®) treated plots while shorter plants were in weedy plots. In interactions, the highest value of plant height was obtained at weeding twice plot with variety Bello while the lowest value was obtained at a weedy plot with variety Yalo. Nine weeks after transplanting (9 WAT) followed a similar trend as 6 WAT.

The weedy plots had the shortest plant throughout the sampling periods probably as a result of strong weed competition with the plant for available growth resources. The superior plant height in plots that were hoe weeded twice and plots that were treated with Force top® might be attributed to their ability to significantly reduce the weed infestation by comparing with sawdust and weedy check plots. This finding is in agreement with that of Imoloame [13] who reported similar observations that plots hoe weeded twice and the plot treated with herbicide had low weed infestation which invariably led to an increase in maize height.

Leaf Area Index: The effect of weed control methods on leaf area index of two varieties of garden egg is presented in Table 5. There were significant ($P<0.05$) differences in weed control methods and their interaction, however, the varieties did not differ significantly ($P > 0.05$) at 3 WAT. Variety Bello tends to have a greater leaf index than a variety of Yalo. Among the weed control method, plots treated with Force top® at 4L/ha gave greater leaf area index than other treatments but it was statistically at *par* with plots mulch with sawdust. Furthermore, the greatest leaf area index on interactive effect was in the plot treated with Force Top® under variety Bello while the lowest leaf area index was in plots that were weeded twice and weedy under both varieties.

At 6 WAT, there were significant ($P < 0.05$) differences in varieties, weed control methods and their interaction. Plots grew with variety Bello significantly gave greater leaf area index than the ones with the variety Yalo. Among the weed control methods, plots hoe weeded twice gave a greater leaf area index than the other weed control treatments. The lowest leaf area index was recorded in the weedy plots. In addition, the highest interactive effect was in plots that were hoe weeded twice under both varieties while the lowest was in the weedy check under both varieties. 9 WAT, followed a similar trend as that of 6 WAT except on interactive effect where the lowest leaf index was in weedy check plots under both varieties and sawdust plot under variety Yalo.

Throughout the sampling periods, plots grew with variety Bello had a lager leaf area index than Yalo probably because of its broad genetic base. The superior leaf area index recorded in plots hoe weeded twice and that of force top treated plots might be attributed to low weed dry weight. There was little or no weed competition

Table 5: Effect of weed control methods on leaf area index of two varieties of garden egg

		Weed control method (WCM)				
Weeks after Transplanting	Variety (V)	Force Top®	Sawdust	Weeding twice	No weeding	Variety mean
3	Yalo	0.30	0.16	0.04	0.03	0.13
	Bello	0.55	0.31	0.05	0.05	0.24
	WCM mean	0.42	0.23	0.05	0.04	
	LSD (0.05)					
	V =		0.204			
	WCM =		0.289			
	VxWCM =		0.408			
6	Yalo	0.93	0.59	1.27	0.28	0.77
	Bello	1.15	0.85	1.45	0.64	1.02
	WCM mean	1.04	0.72	1.36	0.46	
	LSD (0.05)					
	V =		0.209			
	WCM =		0.293			
	VxWCM =		0.414			
9	Yalo =	2.61	1.57	4.11	0.90	2.30
	Bello =	4.18	2.58	5.16	1.78	3.43
	WCM mean	3.39	2.08	4.64	1.34	
	LSD (0.05)					
	V =		0.666			
	WCM =		0.942			
	VxWCM =		1.33			

Table 6: Effect of weed control methods on yield and yield component of two varieties of garden egg

		Weed control method (WCM)				
Yield and component	Variety (V)	Force Top®	Sawdust	Weeding twice	No weeding	Variety mean
No of fruits	Yalo	10.33	6.33	10.67	4.00	7.83
	Bello	11.67	8.00	12.00	4.33	9.00
	WCM mean	11.00	7.17	11.33	4.17	
	LSD (0.05)					
	V =		1.027			
	WCM =		1.452			
	VxWCM =		2.053			
Yield (kg/ha)	Yalo	14983	6872	15088	2049	9748
	Bello	17067	8984	17333	2112	11374
	WCM mean	16025	7928	16211	2081	
	LSD (0.05)					
	V =		116.6			
	WCM =		164.9			
	VxWCM =		233.2			
WI (%)	Yalo =	0.69	54.45	0.00	86.41	35.39
	Bello =	1.52	48.16	0.00	87.81	34.37
	WCM mean	1.11	51.31	0.00	87.11	
	LSD (0.05)					
	V =		0.484			
	WCM =		0.684			
	VxWCM =		0.967			

WI = Weed index

Table 7: Economic assessment of the different weed control methods on two varieties of garden egg

	Cost of production (US$)		Sale Revenue (US$)		Profit (US$)		Benefit-cost ratio	
Treatments	Bello	Yalo	Bello	Yalo	Bello	Yalo	Bello	Yalo
Force top	2678.30	2678.30	32973.34	20676.47	30295.04	17998.18	11.31	6.72
Saw dust	2851.07	2851.07	17357.03	9483.33	14505.96	6632.26	5.09	2.33
Weeding twice	5417.86	5417.86	33487.25	20821.37	28069.39	15403.51	5.18	2.84
No weeding	2657.87	2657.87	4080.37	2827.61	1422.50	169.73	0.54	0.06

1kg of variety Bello was US$1.93, while Yalo was US$1.38 at Choba market in Port Harcourt, Rivers State in 2019.
1US$ equal to ?362.32 between August and September, 2019 as at time of harvesting for sale of these garden eggs.

with the crop for available growth resources hence they were able to produce a larger leaf area with more leaves when compared to other treatments.

Yield and Yield Component: The effect of weed control methods on yield and yield component of two varieties of garden egg is presented in Table 6. There were significant ($P < 0.05$) differences in varieties, weed control methods and their interaction for yield and yield component. Variety Bello had more fruits than variety Yalo. Among weed control methods, plots that received twice weeding had several fruits than other treatments but it was statistically similar to that of plots that were treated with Force Top®. The weedy plots had the lowest number of fruits. In interactive effects, plots that were hoe weeded under Bello produced the highest number of fruits and it was closely followed by a plot treated with Force Top®. The lowest numbers of fruits were produced by weedy check under both varieties. The lowest number of fruits recorded in weedy plots when compared to other treatments could be attributed to serious weed competition with the crop. In most cases, the weeds grew taller and wild shade the plant which deprives the crop of sunlight energy needed for photosynthesis coupled with competition for moisture, carbon dioxide nutrients and space.

Between the two varieties, the higher yield was obtained in Bello than in Yalo. Among the weed control methods, plots that received two hoes weeding at three and seven WAT produced a significantly higher yield than other treatments but it was at *par* with that of plots that were treated Force Top®). In interactions, the highest yield was produced by plots that were hoe weeded twice at three and seven WAT with variety Bello and closely followed by plots treated with Force top®. The lowest yields were produced by weedy check plots under both varieties. Garden egg yield was higher in plot hoe weeded twice and (Force top®) treated plots probably as a result of low weed infestation throughout the critical period of weed control. Besides, they develop a larger leaf area index which implies that they have good canopy formation. The good canopy formation prevents sunlight from penetrating the soil surface that could have stimulated weed germination and weed growth. On the other hand, their larger leaf area was also a plus because they were able to capture sunlight easily which promotes photosynthesis that translated into higher yield. Higher yield in crops such as maize from plot hoe weeded and herbicide treated has been reported by Tunku *et al.*, Imoloame, [12, 13]. Weed competition could have been the possible reason for low yield recorded in the weedy plots.

The weed index in variety Bello was lower than that of variety Yalo. Among the weed control methods, plots that were manually hoe weeded twice had the lowest weed index closely followed by plots treated with Force top®. The highest weed index was in the weedy plots. In interaction effects, the lowest weed index was in plots that were weeded twice and closely followed by plots treated with Force top® under both varieties. A yield reduction (weed index) of 87.11% as a result weed competition was obtained from the weedy plots when compared to the weeding twice plots. The result of this finding is also similar to that of Ekwu *et al.* [14] who noted that uncontrolled weed growth of garden eggs plant can cause percentage yield loss of about 90% in Nigeria.

Economic Assessment of the Different Weed Control Methods on Two Varieties of Garden Egg: The economic assessment of the different weed control methods on two varieties of garden egg is presented in Table 7. The highest cost of production in both varieties of garden egg was recorded in plots that w ere weeded twice. This may be due to the scarcity of labour which led to an increased cost of weeding. Omovbude and Udensi [15] also noted that the cost of manual weeding was higher in hoe weeded plots than in herbicidal plots. In the same vein, Ekeleme [16] also noted that 25-55% of the total cost of production is spent on weeding operation and manual labour in most crops. The least cost of production was in

the weedy check. In Nigeria, herbicidal usage was found to be more profitable than manual hoe weeding in some crops [13, 17, 18]. In this current study plot treated with Force top® at 4 L /ha had the highest profit and the highest benefit-cost ratio when compared to other treatments. The lower cost of production and profit was obtained from no weeding treatment. Generally, between the two varieties, the profit margin was higher in Bello than in Yalo. A combination of variety Bello and Force Top® at 4L/ha gave the highest profit than in other treatment combinations.

CONCLUSION

Weed suppression and crop performance was better in variety Bello than in variety Yalo. The most effective weed control was obtained in weeding twice than in other treatments. The combination of variety Bello and weeding twice was more effective in controlling weeds and enhancing garden egg performance than other treatment combinations. More profit was obtained when 4L/ha of Force Top® was used for controlling weeds in the garden egg. Therefore, a combination of variety Bello and Force Top® at 4 L/ha is recommended to farmers in the study area.

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