EFFECTS OF WEEDING REGIMES AND MINERAL FERTILIZER ON GROWTH COMPONENTS OF *Basella rubra* IN ONDO, SOUTHWESTERN NIGERIA

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ABSTRACT

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Weed interference and poor soil fertility remain major problems facing vegetable in southwestern Nigeria. Therefore, two experiments were concurrently conducted at the Research and Training Farm, Department of Agricultural Science of Adeyemi College of Education Ondo, Southwestern Nigeria and Okegun, Ondo to determine the interaction effects of NPK fertilizer on growth performance and weed density of Basella rubra. The experiment was a 3 x 3 factorial in a randomized complete block design and replicated three times comprising three rates of NPK (20:10:10) fertilizer (0, 200 and 400kg ha^{-1}) and three weeding regimes (No weeding, One weeding and two weeding). Results indicated that compared with the control (W0N0), the plots weeded combined with NPK 20:10:10 fertilizer at all rates significantly increased ($P<0.05$) plant height, number of branches and fresh leaf weight of Basella rubra. The order of increase in the leaf weight of Basella rubra were W_2N_{400} > W_1N_{400} > W_2N_{200} > W_1N_{200} > W_1N_0 > W_1N_{200} > W_0N_{200} > W_1N_0 > W_0N_0. The treatment W_0N_{400} recorded the highest increase in weed density followed by un-weeded plots W_0N_0. weeding regimes combined with fertilizer application had better effect on the growth components of Basella rubra.than when weeding and fertilizer application were not combined.

Keywords*: Basella rubra, weeding regime, NPK 20:10:10, growth weed density*

INTRODUCTION

Indian spinach (*Basella rubra)* is cultivated for its young succulent vine-like shoots and leaves which are relatively high in food value. Tindal (1993) gave nutrient value of *B. rubra* per 100g of edible portion of fresh leaves as 85g water, 4.0g protein, 250mg calcium, 35mg phosphorus, 4.0 g iron which is recommended for nursing mothers, and other vitamins and minerals. Basella leaves also contain mucilage and are normally cooked with meat and the cotyledonous leaves can be eaten raw. It is also widely consumed for its soothing laxative effects in human diets (Tindal, 1983). Farmers grow it because of its high water content and fibre which provides essential roughage. It has positive effects on human health as it reduces some chronic diseases such as hypertension and, it is highly desired for use as a traditional medicinal plant particularly for treating hypertension (Baynes, 1991). The juice from the fruits is used sometimes as food colouring while the dark red juice is used as both dye and ink in ancient China. In Nigeria, *B. Rubra* is an unexploited leafy vegetable, though it has much desired supply of protein, vitamins and mineral nutrients vital for healthy growth in human diets. Despite the multifarious nutritional advantages of this crop, it is yet to be grown on a large scale in Ondo state. Moreover, most local farmers grow *B. Rubra* in backyards along water drains or in waterlogged areas for off-season vegetable supplies. However, weeds are recognized as a mojor constraint that seriously lower the yield and quality of Basellaby competing for available water, nutrients, carbon dioxide and ligh.Researches on weed interference and nutrient availability on yield components of *B. rubra* are scarce especially in Ondo Southwestern, Nigeria. Therefore, this study was conducted to determine the effects of weeding regimes and mineral fertilizer application on growth components of *B. rubra*.

MATERIALS AND METHODS

Two experiments were concurrently carried out in the Teaching and Research Farm of Adeyemi College of Education, Ondo in March, 2014 and Okegun farm, Ondo for a period of nine weeks. Ondo is located in latitude 70°05′N, Longitude 40°55′E and at elevation of 381.3m above the sea level. It belongs to the tropical rain forest zone.It has mean annual rainfall of 1,200mm (Harpstead, 1975).The experiment was a 3 x 3 factorial in a randomized complete block design and replicated three times comprising three rates of NPK (20:10:10) fertilizer (0, 200 and 400kg ha^{-1}) and three weeding regimes (No weeding, One weeding and two weeding). The plot size was 7m x 7m with 1m discard area. Each treatment combination was replicated four times. The spacing used was 1m x1m.

Basella rubra seeds were sown inside seed trays at a spacing of 1cm x 1cm and later transplanted at three weeks after planting to the permanent field. The first weeding and application of fertilizer were carried out at two weeks after transplanting (WAT). The second weeding was carried out four WAT. The weeds common in the Research

and Teaching Farm and Okegun Farm in Ondo where the experiments were conducted were *Aspillia africana*, Euphorbia spp, *Amaranthus spinosus*, *Eleusine indica, Syndrella nodiflora* and *Digitaria horizontalis.*

Soil analysis

Before the conduct of the experiment, initial soil analysis was carried out to determine the nutrient status of the soil. The soil samples were collected from 0 -20cm depth, air dried and 2mm sieved. Soil pH was determined using soil/water ratio (2:1) and pH meter was used to read the value. Organic matter was determined by dichromate oxidation method (Walkley and Black 1934.) Total N was determined by microcjekdhal method. Available P was extracted by ammonium acetate and determined colorimetrically. Exchangeable K, Ca and Na were extracted by ammonium acetate. Potassium was determined by flame photometer while Ca and Na were determined by Atomic absorption spectrophotometer.The soil texture was determined by Bouycous method. Staking was carried out six weeks after planting.

Data collection and analysis

Data were collected at weekly interval beginning from three WAT. The experiment was terminated at six WAT. A quadrat measuring 25cm x 25cm was used to determine the weed density per plot at harvest. Data were collected on number of leaves, number of branches, stem girth was measured with vernier caliper and fresh weight of the plant per plot. The mean data of the two experiments were generated for data analysis. The data collected were subjected to Analysis of Variance and significant Means compared using DMRT at 5% level.

RESULTS AND DISCUSSION

Pre-planting soil analysis showed that the soil has a pH value of 5.2. The textural class was sandy clay with 65% sand, 13% silt and 22% clay. The Ca, Mg, K, Na and CEC contents of the soil were 2.9, 0.4, 0.3, 0.14 and 4.3 Cmol kg^{-1} for respectively. The organic matter and N contents were 0.12 and 2.23 %, respectively. This is in line with earlier reports of Ayeni (2010, 2012, Ayeni, 2011), Ayeni and Adeleye (2011) that the experimental site was slightly acidic, low in OC, N, P, K and CEC. Therefore, the soil requires soil amendment for optimum crop production. Table 1 shows the growth pattern of *B. Rubra* as influenced by NPK (20:10:10) fertilizer combined with weeding regimes. Compared with W_0N_0 (No weeding, No fertilizer), the plots that were weeded twice combined with application of 400kg ha^{-1} NPK (20:10:10) fertilizer (W_2N_{400}) had the highest significant increase ($p<0.05$) in the height of *B. Rubra* at 3,4,5 and 6 WAT. All the plots weeded once (W_1N_{400},W_1N_0,W_1N_{200} and W_1N_2) or twice(W_2N_0,W_2N_{200} and W_2N_{400}) had higher increase in *B. Rubra* height at 5 and 6 WAT compared with un-weeded plots This finding is in line with the work of Nadeem *et al* (2010), and Chauham *et al.* (2010). This shows that weeding is also one of the factors responsible for the growth of *B.rubra* since the plots weeded performed better than the plots that were not weeded. Smith *et al*. (2009) also observed that weeded plots in the experiment performed to show the effect of weeding on *Basella alba*. Rao (2000) observed that the extent of weed competition depends on the type of weeds species, the severity of weed infestation, duration and climatic factors.*Basella rubra* grown on the plots weeded twice performed better than the *Basella rubra* grown in plots weeded once before harvesting.

It was observed that the plots weeded once or twice without fertilizer application (W_2N_0, W_1N_0 and W_0N_0) had shorter Basella vine length compared with W_2N_{400} showing that NPK (20:10:10) also influenced the growth of *B. rubra* positively. Nitrogen fertilizer is an essential plant nutrient that forms part of chlorophyll molecules and its adequate supply is associated with vigorous vegetative growth(Stephens,1982. The presence of N in NPK fertilizer used might have enhanced vegetative growth of *Basella rubra*. Makinde *et al*. (2010) also affirmed that fertilizer application increased growth and yield components of *amaranthus* in the experiment performed on the morphological characteristics of *Amaranthu scruentus* as influenced by kola pod husk, organomineral and NPK fertilizers on Orthic luvisols and Dystric fluvisol in southwestern Nigeria. Robert *et al*. (1977) stated that weeds on the farm deprived crops of water, light and mineral nutrients, thus presence of weeds reduce plant growth.

Table 1: Interaction Effect of weeding period and NPK 20:10:10 fertilizer rate on *Basella rubra* height in 2014

Table 2 shows that the weed densities were higher in the plots that were not weeded compared with the weeded plots. The plots that were not weeded, but with application of 400kg ha^{-1} NPK (20:10:10) fertilizer (W_0N_{400}) had higher weed density compared with W_0N_0. This finding was in line with the observation of Ekwu *et al*. (2012) and Smith *et al*.2009) on weed densities and fertilizer in the experiments they conducted on the effect of NPK fertilizer and weeding regimes on the growth and yield of eggplant. This might be as a result of the fertilizer applied at the highest rate (400kg ha^{-1}) which might have caused proliferation of the weeds because application of fertilizers at high dose is known to increase weed population. Weeding twice significantly ($p<0.05$) reduced weed density, hence, the increase in *B. rubra* agronomic parameters (Table 3).

Thee interaction effect between weeding regimes and fertilizer application on growth and yield of *B.rubra* was significant (Table 3). Bergquist, (2006) suggested that weed population should be kept to minimal tolerable level if optimum yield of crops is to be achieved. Compared with the no weeding and no fertilizer application (W_0N_0), all the treatments significantly increased ($P<0.05$) the number of branches and number of leaves (except W_0N_{200} and W_0N_{400}).The treatments also increased ($P<0.05$) *B.rubra* girth compared with W_0N_0 except W_0N_{400}.The

broadness and weight of the leaves determine the quality and marketability of *B. rubra* and other vegetables. The *B.rubra* treated withW_2N_{400} had the highest fresh leaf area and weight.
The order of increase in *B. Rubra* were: $W_2N_{400} > W_1N_{400} > W_2N_{200} > W_1N_{200} > W_1N_0 > W_0N_{200} > W_0N_{400} > W_2N_0 > W_0N_0$.The order of increase in the leaf weight of *B. rubra* were: $W_2N_{400} > W_1N_{400} > W_2N_{200} > W_1N_{200} > W_1N_0 > W_0N_{200} > W_0N_{400} > W_2N_0 > W_0N_0$.Two weeding regimes plus 400kg/ha of NPK (20:10:10) fertilizer most influenced the growth parameters of *B. rubra*.

Treatment	.....weeks after transplanting (cm).....			
	1	2	2	4
W0N0	20ab	23bc	36c	52c
W3N400	25a	30ab	43b	66c
W1N400	20ab	33a	45b	80b
W1N0	10d	22c	38bc	78c
W1N200	14c	27b	47b	88b
W0N400	19b	28b	62a	97a
W2N0	13cd	22c	37c	72c
W0N200	16c	22c	32c	67c
W2N200	15c	24b	43b	87b

Figures with the same alphabet in the same column are not significantly different at 5% DMRT
Key: W_0N_0 - No weeding, No fertilizer (control) W_0N_{200} – 200kg ha^{-1} NPK only , W_0N_{400} – 400kg ha^{-1} NPK only, W_1N_0 – one weeding without fertilizer, W_1N_{200} – One weeding with 2ookg ha^{-1} fertilizer NPK, W_1N_{400} – One weeding with 400kg ha^{-1} NPK W_2N_0– Two weeding only, W_2N_{200} – Two weeding with 200kg ha^{-1} NPK, W_2N_{400} – Two weeding with 400kg ha^{-1} NPK

Table 2: Interaction Effect of weeding and NPK 20:10:10 fertilizer on weed density and agronomic parameters of *Basella rubra* 2014

Treatment	weed density	no of branches $plant^{-1}$	no of leaves $plant^{-1}$	stem girth $plant^{-1}$ (cm)	fresh leaf weight $plant^{-1}$
W0N0	417.39a	5.43b	54.80c	5.30a	3.20c
W0N200	46.96d	6.00b	65.00c	5.20a	4.00c
W0N400	40.70d	6.37b	59.00c	5.00a	3.40c
W1N0	129.32c	8.53a	110.00a	6.10a	7.37ab
W1N200	159.90c	9.00a	123.00b	5.60a	5.32b
W1N400	424.38a	9.97a	158.17a	6.30a	12.00a
W2N0	38.86d	8.68a	137.09b	6.24a	6.70b
W2N200	43.96d	10.20a	140.73ab	6.35a	10.65a
W2N400	45.39d	11.30a	168.45a	6.72a	13.40a

Mean with the same letters in the same column are not different at 5% using Duncan Multiple Range Test
Key: W_0N_0 - No weeding, No fertilizer (control) W_0N_{200} – 200kg ha^{-1} NPK only , W_0N_{400} – 400kg ha^{-1} NPK only, W_1N_0 – one weeding without fertilizer, W_1N_{200} – One weeding with 2ookg ha^{-1} fertilizer NPK, W_1N_{400} – One weeding with 400kg ha^{-1} NPK W_2N_0– Two weeding only, W_2N_{200} – Two weeding with 200kg ha^{-1} NPK, W_2N_{400} – Two weeding with 400kg ha^{-1} NPK

Table 3: Effect of weeding regimes on weed density and growth components of *Basella rubra* 2014

Treatment	Weed density	no of branches $plant^{-1}$	no of leaves $plant^{-1}$	stem girth $plant^{-1}$ (cm)	fresh leaf weight $plant^{-1}$ (g)
W0	422.89a	5.92c	22.56b	5.22b	3.79c
W2	151.67b	8.31b	26.21b	6.02a	7.29a
W3	43.22c	9.48a	53.13a	6.47a	12.18a

Mean with the same letters in the same column are not different at 5% using Duncan Multiple Range Test. Use LSD instead of DMRT. *W_0 = No weeding, W_1 = weeding once, W_2 = weeding twice*

Tables 3 and 4 showed individual effect of weeding regimes and fertilizer application on growth component of *B. rubra.* Compared with control, W_1 and W_2 significantly increased number of branches and fresh leaves weight of *B. rubra*. The plots that were weeded two times (W_2) had the lowest weed density followed by the plots weeded once. This result clearly showed that weeds have negative effect on growth components of *B. rubra.* NPK 20:10:10 fertilizer had higher influence on weed density, number of branches, number of leaves, girth and fresh weight of *B. rubra*. The plots fertilized with 200 and 400 kg ha^{-1} NPK 20:10:10fertilizer significantly increased weed density, number of branches, number of leaves and fresh leaves weight of *B. rubra*. Findings of this study are in line with that of Khan *et al*.,(2008) that weeding increased the yield of Indian Spinach, growth and reduced weed density in the experiment conducted to show the effect of weed duration and weed control on the yield of Indina Spinach.

Table 4: Effect of NPK 20:10:10 fertilizer on weed density and growth components of *Basella rubra* in 2014

Treatment	weed density	no of branches plant^{-1}	no of leaves plant^{-1}	stem girth plant^{-1}(cm)	fresh leaf weight plant^{-1}
W0	195.11b	6.20b	86.00a	6.01a	6.34c
W2	211.44a	6.29a	8.51b	5.64a	7.12b
W3	214.42a	9.22a	9.19b	6.06a	9.80a

Mean with the same letters are not different at 5% using Duncan Multiple Range Test .
W_0 = No weeding, W_1 = weeding once, W_2 = weeding twice

CONCLUSION

Experiments were conducted in Ondo southwestern Nigeria to determine the effects of weeding regimes and mineral fertilizer application on growth components of *B. rubra*. Weeding combined with fertilizer application increased Basella rubra height, girth, number of leaves and branches and weight of the leaves. The plots that were not weeded had higher weed population than the plots that were weeded. Also, the plots that high rate of NPK fertilizer were added increased weed population. Integrated application of fertilizer and weeding regimes could be used to enhance optimum production of *Basell arubra*.

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