

POPULATION EFFECT OF SWEET POTATO ON WEED CONTROL, GROWTH, AND YIELD OF COMPONENT CROPS IN MAIZE SWEET POTATO INTERCROP

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Abstract

*The effect of population of sweet potato (*Ipomea batata* L) on weed control, growth and yield component crops in maize/sweet potato intercrop were examined during the planting season of 2020 at Research Farm of Oyo State College of Agriculture and Technology, Igbo-ora, Oyo State. The treatments used were; 20,000, 40,000, 60,000 and 80,000 plant population densities of sweet potato. The treatments were randomly assigned to plots using Randomized Complete Block Design (RCBD) and replicated three times. Plot size was 2x 3m with 0.5m space in between the replicates to ease movements for field operation. Data collected weed control at 4 and 6 weeks after planting (WAP), weed dry weight at 6 WAP, maize growth parameters (height (cm), leaf area (cm²) and girth size (cm) and yield (kg/ha) (maize and potato). Data taken were analysed using Analysis of Variance and Means separated by Duncan Multiple Range Test (DMRT) at 5% level of significance. The result obtained from this work showed that plant population 80,000plant/ha had a better weed control effect than 60,000, 40,000 and 20,000 plant population respectively. Although, the yields of the component crops are thus depressed under this population density (80,000) of sweet potato compared with others. Hence, it is recommended that farmers in Nigeria should control weed with sweet potato, at 40,000plants/ha to enhance farmers' productivity and income.*

Key words: Population, Weed control; Maize/Sweet potato intercrop; Growth and yield of component crops

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop after sorghum (*Sorghum bicolor*) and millet (*Pennisetum glaucum*) in Nigeria and it is a major staple food to large number of human population in the world (Farhad *et al.*, 2009). It is also as fodder and industrial material and its production is at both subsistence and commercial levels in Nigeria (Eleweanya *et al.*, 2005). Thus, the crop has an immense potential in the tropics and at times can produced up to 7.5t/ha when properly managed. Unfortunately, yields are still generally below 5t/ha (FAO, 2007) and this had cause inadequacy of maize for its numerous purposes. Maize is most sensitive to weeds completion especially during early stage of crop growth.

Weeds compete with crops in different ways, and decrease quality and quantity of agricultural products. Results of some studies showed that weeds are able to use nutrition of soil more than crops Rashid *et al.*, 2008). The highest damage is caused by weeds, pests and diseases. This damage is estimated between 10 to

15 percent of total production in developed countries and more in the developing Countries of tropical region. The intensive use of a limited number of herbicides creates a situation where herbicide resistance is more likely developed. To mitigate the intermitted weed effects on small scale maize production in the tropical region of Nigeria, alteration of some cultural practices such as planting dates, row spacing, planting population and intercropping of drought tolerant crops such as sweet potato (*Ipomoea batata* L.) with maize could improve maize ability to establish dominance over stresses (Weeds and drought) and increase grain yield (Rajeshkumar *et al.*, 2017).

More so, the commonest cropping system in the tropics is intercropping. Intercropping, is the growing of two (or more) crops simultaneously on the same area of ground (Willey, 1990), has potential advantages such as higher overall productivity better pest and disease control, and enhanced ecological services (Finch and Collier, 2012). Thus, Anil *et al.* (1998) conclude that the advantages of intercropping

include soil conservation, lodging resistance, yield increment and weed control Bani *et al.* (2006) over mono-cropping. Most farmers in Nigeria preferred mixed-cropping and crop like sweet potato is mixed with either maize or guinea corn (*Sorghum bicolor*). One of the major reason advanced by farmers for intercropping a low growing crop with a more erect growing crop like maize is to obtain some measures of weed control (Akobundu, 1980).

Sweet potato has been used to control weed in cropping systems. However, the suitability of maize with sweet potato for weed control has not been properly documented. Therefore, it is very paramount to examine sweet potato/maize mixture for effective weed control in the cropping system. The drudgery, high cost and availability of labour make hand weeding not so attractive while the high cost and the high technology required in the use of herbicides also render herbicides precarious for use by the farmers. The only alternative weed control option devoid of all the above mentioned problems is the use of cropping systems or intercrops which are organic, biotechnological and non-deleterious to the test crops, soil and the applicator. The aim of this study was to determine the effects of population of sweet potato on weed control, growth and yield of component crops in maize/sweet potato intercrop.

Materials and Methods

Field experiment was carried out to determine the effects of different plant population densities of sweet potato in the control of weeds in maize was carried out at Oyo State College of Agriculture and Technology Research Farm, Igbo-ora during the planting season of 2020. Maize seeds (Swan-Y), already treated to be pest and disease resistant were obtained from the Institute of Agriculture Research and Training (IAR & T), Moor plantation, Ibadan while sweet potato stolons gotten from a local farm in Igboora were used as the treatment for the experimental work. The experimental area for the project was 10 m x 12 m.

Land preparation and experimental treatments

The land was prepared using conventional tillage method of ploughing and harrowing, and leveling was done with hoe on the 11th of July, 2020, after which the land was divided into three replicates consisting of 12 plots. The experimental treatments were four and includes the following; Maize + Sweet potato (20,000plants/ha), Maize + Sweet potato (40,000 plants/ha) , Maize + Sweet potato (60,000 plants/ha) and Maize + Sweet potato (80,000 plant/ha). Maize was planted at 53,000 plants/ha throughout all the treatments. The treatments were randomly assigned to

plots using Randomized Complete Block Design (RCBD) and replicated three times. Plot size was 2 x 3m given 6m² with 0.5m in between the replicates to hasten movements for field operations.

Maize at constant plant population density of 53,000 plants per hectare was combined with sweet potato (local variety) at the varying plant population densities of 20,000, 40,000, 60,000 and 80,000 respectively. Consequently, maize was planted at the spacing of 0.50 x 0.75 m to give 53,000 plants/ha while sweet potato was spaced at 0.5 x1.0m, 0.5 x0.5m, 0.42 x0.5m and 0.25 x 0.5m to achieve the various plant population densities of 20,000, 40,000, 60,000 and 80,000 plants/ha for sweet potato respectively. The treatments were randomly distributed to the various plots using Randomized Complete Block Design (RCBD) with three replications. Plots size was 2 x3m. Maize variety Swan-Y was planted on July 18,2020 using 3 seeds per hole and was later thinned down to 2 plants per stand to give a plant population of 53,000 plants/ha. Sweet potato (Red skinned local variety) was also planted on the same day (July 18, 2020).

Assessment of weed control effectiveness of the treatments

Weed control effectiveness of the sweet potato was measured at 6 and 8 WAP through visual ratings using the scale 0-100 where 0 = control, 100 = complete control.

Measurement of the growth parameter of Maize

Three (3) maize plants per plot were destructively sampled to determine various growth parameters of maize. The height of maize was measured with a long wooden ruler, stem diameter with caliper, number of leaves was taken by physical counting and the leaf area was measured by taking the length and breadth of three leaves per plant (using the the biggest, medium and smallest selected leaves per plant). The stem diameter was converted to circumference by using the formula $c = 2\pi r$ to determine the girth of maize while leaf area per plant was determined by finding the product of leaf length and breadth and multiplied with a correction factor 0.75. The figure obtained was further multiplied with the number of leaves per plant. Data collected were statistically analysed and means separation were done using analysis of variance and the means were separated by Duncan Multiple Range test (DMRT) at 5% level of significant.

Results

Table 1 showed that maize/sweet intercrop had significant effects ($p \leq 0.05$) on weed control at 4 and 6 weeks after planting. Sweet potato planted at

population of 80,000 plants/ha (25x 50cm) had the highest weed control efficacy followed by 60,000plants/ha (41.60 x 40cm) but were not significant from one another. However, 40,00plants/ha (50x50 cm) produced higher weed control effects while the use of 20,000 plants/ha (50 x 100 cm) sweet potato inter crop gave the lowest weed control throughout the sampling period.

Table 2 shows significant effects maize/sweet potato intercrop on weed dry weight at 6WAP. From the result weed dry weight was highest in plots with 20,000 plants/ha of sweet potato (50 x 100 cm) followed by 40,000 plants/ha (50 x 50 cm) and 60,000 (41.60 x 40 cm) respectively. The lowest weed dry weight was produced by 80,000 plants/ha (25 x50 cm) plots at 6 WAP.

Table 3 shows the effect of maize/sweet potato intercrop on growth parameters of maize. The population of sweet potato in the intercrop had significant effects ($p \leq 0.05$) on the growth parameters of maize considered. The maize plots with sweet potato planted at 20,000 plants/ha (50 x100 cm) produced the highest height, leaf area and girth circumference restively. This was followed by 40,000 plants/ha (50 x50 cm) and 60,000 plants/ha (41.60 x40 cm) in that order while the use of 80,000 plants/ha (25 x 50 cm) gave the shortest response from all the growth character taken. There was no significant effect ($p \geq 0.05$) between the characters considered on plots 40,000plants/ha (50 x 50 cm) and 20,000 plants/ha (50 x 100 cm) with the exception maize height (cm).

Table 4 shows the effect maize/ sweet potato intercrop on the yield of maize. Maize/sweet potato intercrop had significant effect ($p \leq 0.05$) on yield of maize produced. Yield of maize had no significant effect ($p \geq 0.05$) under the populations of 20,000 and 40,000 plants/ha of sweet potato respectively. Although, the use of the plots with 40,000 plants/ha (50 x 50 cm) had the highest maize yield from the maize/sweet potato intercrop while the plots with 80,000plants/ha (25 x 50 cm) produced the lowest maize yield from the intercrop.

Table 5 shows effect of maize/sweet potato intercrop on the yield of sweet potato. Maize/sweet potato intercrop had significant effect ($p \leq 0.05$) on the yield of sweet potato produced . Yield of sweet potato from plots 20,000 plants/ha (50 x 100 cm) had the highest sweet potato compared to other treatments. The yield of sweet potato shows slight significant difference

between plots 40,000 plants/ha (50 x50 cm) and 20,000 plants/ha (50 x 100cm) population respectively.

Discussion

In this study, variation of sweet potato in the maize/sweet potato influenced the growth performance of maize throughout the period of the experiment and the yields of the components crops. The performance from Table 1 indicated that weed suppression decreased with increase in the population of sweet potato. Therefore, the higher the population of sweet potato the more the coverage of the land surface thus preventing the weeds survival. This ascertained the findings of Tsubo *et al.* (2005) who reported that cropping system that reduces weed population may provide a weed suppressive foundation upon which cultural weed control could be laid.

The performance of weed dry weight at 6 WAP indicated that weed weight decreased as the efficacy of weed control measure increased. This agrees with a similar work carried out on intercropping by Takim and Fadayomi, (2010) where there was a general reduction in weed density and dry matter in intercropped compared with the sole crop plot. Similarly, the response shown from Table 3 on maize growth parameters explained that the growth parameters of maize decreased with increase in population of sweet potato.

The yield of maize produced from the maize sweet/ potato intercrop inferred that the yield of maize decreases with increase in plant population of sweet potato. However, a fall in the yield of maize after increase in sweet potato population of 40,000plants/ha/ha-(50 x50cm) to 20,000plants/ha (50 x 100cm) affirmed a limit with which the population of sweet potato could be increased in the controlling of weeds in the intercrop. This pattern of efficacy in the maize/sweet potato intercrop has observed with sweet potato population variation is also confirmed from the yield of sweet potato recorded. This result further, corroborated with the work of Prasad and Brook (2005) who reported that increasing maize plant density had significant effect on maize/sweet potato intercropping and Maluleke *et al.* (2005) also ascertain that maize dry matter was reduced with increasing Labla population (6- 10 plants perm²).

**Table 1: % weed control at 4 and 6 weeks after planting in maize sweet potato intercrop**

Treatment	4 WAP	6WAP	Mean
80,000 plants/ha (25 x50cm)	80.67a	89.00a	84.84a
60,000 plants/ha (41.60 x40cm)	71.67a	75.67a	73.34a
40,000 plants/ha (50 x50cm)	43.33c	66.33b	54.83b
20,000 plants/ha (50 x 100cm)	53.00b	51.33c	53.17b
S.E	3.0551	4.1339	

means followed by the same letter are not significantly different at $p<0.05$ **Table 2: Weed dry weight at 6 weeks after planting**

Treatment	6 WAP
80,000 plants/ha (25 x50cm)	0.46d
60,000 plants/ha (41.60 x40cm)	1.13c
40,000 plants/ha (50 x50cm)	1.68b
20,000 p[ants/ha (50 x 100cm)	2.46a
S.E	0.14250

means followed by the same letter are not significantly different at $p<0.05$ **Table 3: Growth parameters of maize**

Treatment	Maize height (cm)	Leaf area (cm ²)	Girth circumference (cm)
80,000 plants/ha (25 x50cm)	0.15c	0.30b	4.67b
60,000 plants/ha (41.60 x40cm)	0.19b	0.34b	5.44b
40,000 plants/ha (50 x50cm)	0.23b	0.42a	6.63a
20,000 plants/ha (50 x 100cm)	0.27a	0.45a	7.17a
S.E	0.01202	0.01543	0.28717

means followed by the same letter are not significantly different at $p<0.05$ **Table 4: Yield of maize in maize/ sweet potato intercrop**

Treatment	Yield (kg/ha)
80,000 plants/ha (25 x50cm)	723.33c
60,000 plants/ha (41.60 x40cm)	1200.00b
40,000 plants/ha (50 x50cm)	2362.33a
20,000 p[ants/ha (50 x 100cm)	2277.33a
S.E	128.77

means followed by the same letter are not significantly different at $p<0.05$ **Table 5: Yield of sweet potato in maize/ sweet potato intercrop**

Treatment	Yield (kg/ha)
80,000 plants/ha (25 x50cm)	2499.67dc
60,000 plants/ha (41.60 x40cm)	2722.00c
40,000 plants/ha (50 x50cm)	2944.00ba
20,000 plants/ha (50 x 100cm)	3722.00a
S.E	235.67

means followed by the same letter are not significantly different at $p<0.05$

Conclusions

This study concludes that intercropping system may be eco-friendly approach for reducing weed problems without the use of chemicals. Intercropping maize and sweet potato at various population densities may affect yields of component crops and weed suppression with regards competition exacted. Although, yield of maize in maize –sweet potato

intercrop decreases as the population of potato increased in the intercrop up till 400,000plants/ha. In maize weed suppression decreased with increase in the population of sweet potato. However, population densities of sweet potato at 80,000 is highly significant in controlling weeds compared to others (60,000, 40,000 and 20,000) plant population. Thus, the use of 40,000 sweet potatoes for the intercrop

should be preferred for maximum economic returns and good yields of the component crops.

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