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Evaluation of weed management strategies in cocoyam (colocasia esculentus (L.) schott) production in Ado-Ekiti, Ekiti State Nigeria

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Abstract

Field trials were conducted at the experimental site of the Department of plant Science of the Ekiti State University, Ado Ekiti during the growing seasons of 2011 and 2012. Ado Ekiti is located on Latitude 7^0,40^0 N and Longitude5^0, 15^0 E with a bimodal rainfall pattern of about1450mm and a mean daily. Temperature of 27^0 c. Sprouted cocoyam corms were planted one per heap. The following treatment combinations were employed: hand weeding at 6 and 12 weeks after transplanting (WAT); Atrazine; Diuron; Atrazine+ hand weeding at 12WAT; Diuron+ hand weeding at 12WAT. Atrazine and Diuron were sprayed a day before transplanting on early weed resurgence at the rate of 2.4 and 2.1kg active ingredient per hectare (a.i.ha^{-1}) respectively. Results from the study showed that there were effective weed control by the herbicides used and their combinations with hand weeding. The highest cormel number and cormel yield (kg $plant^{-1}$) was recorded in the Diuron + hand weeded plots which compared with those of hand weeded plots twice at 3 and 8weeks after planting. It is concluded that Diuron application with supplementary hand weeding will be effective to give an all season weed control and produce optimum yield in the study area.

Keywords: Cocoyam**,** atrazine, diuron, hand weeding, yield.

INTRODUCTION

Cocoyam is a stem tuber that is widely cultivated in the tropical regions of the world and is well known food plant which has a long history of cultivation with Nigeria being the largest producer in the world accounting for about 40% of the total world output (Eze and Okorji, 2003). The crop had been reported to possess high ability to produce high energy food, protein, vitamins and minerals as well as cash income to most food insecure households (Moyo *et al*., 1999; Sandifolo, 2003; Ojinaka et al., 2009). It has relatively small sized starch grains which are easily digestible and therefore acclaimed to be a very good source of carbohydrate for diabetic patients (Ekwe et al., 2009). The corms may be cut up and boiled in curries or fried to make crispy chips, leaves and leaf stalks can also be cooked and eaten like spinach (Nwachuckwu, 2009). Despite the numerous importance of cocoyam in Nigeria and many other nations the potential for food security are grossly underutilized (Ekwe et al., 2009).

A major militating factor in the production of cocoyam in this part of the world is weed infestation especially during the early growth stage of between 4-12weeks. There could be serious yield reduction when weed competition is high during canopy formation and early tuberization (Onochie, 1978). Losses in cocoyam due to weed infestation could be substantial (Oerke et al., 1994). However, precise information on the total economic impact of weeds on cocoyam production has not been properly documented because methods for estimating yield loses often differ and do nt allow easy comparison of different regions of the country (Chikoye, 2000).

Different methods of weed management have been employed in Nigeria to combat weed infestation in cocoyam production, these include cultural control by hand pulling, hand slashing hoeing and mowing of weeds (Ikeorgu, 2000). In Nigeria, farmers seldom rely on the use of herbicides to fight weed menace. The reason for this was attributed to high cost of herbicide which seems too expensive to the resource poor peasant farmers

Table 1. Effects of weed control strategies on weed density in cocoyam field in 2010.

Treatments	Weeks after transplanting				
	6WAT	10WAT	14WAT	18WAT	Mean
Weedy check	41.3a	66.4a	83.0a	64.5a	63.8
Hand weeding	28.8b	15.2d	21.6d	19.3d	21.2
Atrazine	19.3c	39.3b	47.1b	36.3b	35.5
Diuron	15.0cd	25.9c	36.3c	24.5c	25.4
Atrazine + hand weeding	18.4c	18.5d	23.1d	18.1d	19.5
Diuron + hand weeding	14.2d	16.7d	20.4d	17.3d	17.1

Means with the same letter(s) within columns are not significantly different (P=0.05)

Table 2. Effects of weed control strategies on weed density in cocoyam field in 2011.

Treatments	Weeks after transplanting				
	6WAT	10WAT	14WAT	18WAT	Mean
Weedy check	36.8a	53.4a	58.9a	54.6a	50.9
Hand weeding	25.7b	17.5c	19.4d	18.6c	20.3
Atrazine	16.7c	27.4b	37.1b	28.5b	27.4
Diuron	11.4d	22.6b	30.5c	24.3b	22.2
Atrazine + hand weeding	18.1c	16.8c	18.6d	17.1c	17.7
Diuron + hand weeding	11.6d	15.9c	18.2d	16.9c	15.7

Means with the same letter(s) within columns are not significantly different (P=0.05)

(Fadayomi, 1991). However, Akinyemiju and Alimi (1989) reported higher net economic return from the use of herbicide than hand weeding. It had also been noted that a minimum of 50-man labour is required to effectively hoe weed and hectare of land with hard labour, only 4-man labour is sufficient to effectively spray the same area within 4 hours (Ademiluyi, 2004).

The present study was designed to compare various combinations of weed management strategies in reducing weed infestation and their effects on yield of cocoyam in the study area.

MATERIALS AND METHODS

Trials were conducted at the experimental site of the Department of plant Science of the Ekiti State University, Ado Ekiti during the growing seasons of 2011 and 2012. Ado Ekiti is located on Latitude 7^0,40^0N and Longitude5^0, 15^0E with a bimodal rainfall pattern of about1450mm and a mean daily Temperature of 27^0c. Cocoyam cormels with average weight of about 250g were planted on nursery beds and given regular watering for four weeks before the seedlings were transplanted. This was to ensure uniform sprouting of the cocoyam cormels.

The field was manually cleared with cutlass and plots measuring 5m x 4m were laid out with 1m boarder between plots. Heaps were made with Nigerian hoe and each heap was 1m from the other. Cocoyam seedlings were transplanted on may 20 and may 10 of 2010 and 2011respectively. The sprouted cocoyam cormels were planted one per heap. The following treatment combinations were employed: hand weeding at 3 and 8 weeks after transplanting (WAT); Atrazine; Diuron; Atrazine+ hand weeding at 12WAT; Diuron+ hand weeding at 12WAT. Atrazine and Diuron were sprayed a day before transplanting at the rate of 2.4 and 2.1kg active ingredient per hectare (a.i.ha^{-1}) respectively. Sprayer was calibrated to deliver 250L per hectare of the spray solution. Hand weeding was done using cutlass at 3 and 8 weeks after transplanting (WAT). Atrazine or Diuron applied Plots receiving supplementary hand weeding were hand weeded at 8 weeks after transplanting. Weed density and weed biomass were determined at 6, 10, 14 and 18 weeks transplanting.

Collected fresh weed samples were oven dried at 85^oC for 48h to obtain the dry biomass. Cocoyam cormels were harvested at 20WAT.

Data collected were subjected to statistical analysis of variance and means separated multiple range tests.

RESULTS

The effects weed management strategies on weed density in cocoyam field in both seasons are presented in Tables 1 and 2. The highest weed density was recorded

Table 3. Effects of weed control strategies on weed biomass in cocoyam field in 2010.

Treatments	Weeks after transplanting				
	6WAT	10WAT	14WAT	18WAT	Mean
Weedy check	56.1a	78.4a	104.6a	153.5a	98.2
Hand weeding at 6 and 12	16.4b	16.2cd	32.0c	24.1d	22.2
Atrazine	5.4c	28.4b	46.6b	38.9b	29.8
Diuron	5.6c	25.9b	42.3b	33.6c	26.9
Atrazine + hand weeding	6.1c	19.0c	31.5c	23.2d	20.0
Diuron + hand weeding	5.6c	14.6d	29.2c	21.4d	17.7

Means with the same letter(s) within columns are not significantly different (p=0.05)

Table 4. Effects of weed control strategies on weed biomass in cocoyam field in 2011.

Treatments	Weeks after transplanting				
	6WAT	10WAT	14WAT	18WAT	Mean
Weedy check	63.4a	81.1a	126.7a	164.6a	108.95
Hand weeding at 6 and 12	15.8b	21.6c	22.5de	16.3d	18.8
Atrazine	7.5c	29.8b	48.7b	45.9b	32.9
Diuron	7.1c	26.5b	41.2c	33.1c	27.0
Atrazine + hand weeding	8.0c	21.2c	25.6d	17.4d	18.1
Diuron + hand weeding	6.9c	19.3c	20.2e	11.6e	14.5

Means with the same letter(s) within columns are not significantly different (P=0.05)

in the weedy check plots while the lowest was observed in the Diuron + hand weeding plots at 6, 14 and 18 WAT. Weed densities were identical and lowest in the Diuron + hand weeding, hand weeded and Atrazine + hand weeding when assessed at 10, 14 and 18 WAT. Diuron application showed lower weed density than Atrazine. Supplementary hoe weeding also led to higher reduction of weed density in plots receiving either Atrazine or Diuron.

Comparable weed biomass reductions were observed in either the Atrazine or Diuron applied plots up to 6WAT but at 10WAT till 18WAT, Diuron showed lower weed biomass than Atrazine. Hand weeding twice at 3 and 8WAT showed comparable weed reduction with those of Atrazine or Diuron that received supplementary hand weeding when assessed at 18WAT. While Atrazine showed comparable and better weed biomass reduction with hand weeding up to 10 WAT in 2010 and 2011 respectively, higher weed biomass was recorded later at 14 to 18WAT in the Atrazine applied plots (Tables 3 and 4).

Effects of weed management strategies on number of green leaves per cocoyam plant are presented in Table 5. The highest number of green leaves was recorded in the Diuron + hand weeding and the Diuron applied plots in both seasons while the least was recorded in the weedy check plots. Atrazine + hand weeding gave comparable records of number of green leaves with hand weeded plots but lower than the Diuron applied plots. Atrazine applied plots without hand weeding showed lower number of green leaves than the hand weeded plots.

Table 6 presents the effects of weed management strategies on the number of cormels produced by cocoyam plants. In both seasons Diuron + hand weeding recorded the highest number of cocoyam cormels which was not significantly different from the Atrazine + hand weeding and hand weeded plots. Atrazine + hand weeding gave identical cormels number as the Diuron applied plots. Atrazine spayed plots however showed lower number of cormels than the Diuron sprayed plots. The lowest number of cormels was recorded in the weedy check plots in both seasons.

The effect of weed management strategies on cocoyam yield (cormel weight plant^{-1} kg) is presented in Table 7. Similar but highest cormel weight was recorded in the Diuron + hand weeding and the hand weeded plots. In 2011 yields in plots receiving Atrazine + hand weeding and hand weeding were comparable. Atrazine and Diuron without supplementary hand weeding showed comparable yield records in both seasons. The lowest cormel yield was recorded in the weedy check plots.

DISCUSSION

The highest weed density was observed at 14WAT but got reduced at 18WAT in all the treatments. This reduct-

Table 5. Effects of weed management strategies on number of green leaves per plant

Treatment	Number of green leaves plant^{-1} at 14WAT	
	2010	2011
Weedy check	2.9d	2.5d
Hand weeding at 6 and 12	4.6b	4.9b
Atrazine	4.1c	4.2c
Diuron	4.9ab	5.3ab
Atrazine + hand weeding	4.4bc	4.8b
Diuron + hand weeding	5.3a	5.7a

Means with the same letter(s) within columns are not significantly different (P=0.05)

Table 6. Effects of weed management strategies on number of cormels per plant

Treatment	Number of cormels plant^{-1}	
	2010	2011
Weedy check	2.3d	1.9d
Hand weeding at 6 and 12	8.1a	7.6ab
Atrazine	5.6c	5.7c
Diuron	7.5b	6.9b
Atrazine + hand weeding	7.8ab	7.4ab
Diuron + hand weeding	8.2a	8.0a

Means with the same letter(s) within columns are not significantly different (P=0.05

Table 7. Effects of weed management strategies on weight of cormels per plant

Treatment	Cormel weight plant^{-1} (kg)	
	2010	2011
Weedy check	0.41d	0.39d
Hand weeding at 6 and 12	2.59a	2.48ab
Atrazine	1.43c	1.51c
Diuron	1.76c	1.62c
Atrazine + hand weeding	2.03b	2.14b
Diuron + hand weeding	2.65a	2.61a

Means with the same letter(s) within columns are not significantly different (P=0.05)

ion in weed density at a later age of cocoyam could be attributed to closed canopy established by cocoyam which might have suppressed weed growth and even smothered growing weeds. Nwagwu et al., 2000 had reported similar weed reduction at older age of cocoyam. Lower weed density and weed biomass recorded in the hand weeded cocoyam plots and those sprayed with herbicides at an early is an indication of good weed control. It had been reported that weeds which emerged during the first three months after planting are known to endanger yields more than those appearing later (Onochie, 1975). The higher number of green leaves observed in the Diuron or the Atrazine applied plots and the hand weeded plots is also an indication of good weed control in these plots. Higher number of leaves produced by these plots may also have contributed to lower weed number and lower weed biomass observed. It had been observed that when higher canopy closure occurs, weeds are kept reasonably in check (Owueme, 1978).

The comparable and highest cormel number and weight recorded in the Diuron + hand weeding and the hand weeded plots is probably an indication of effective weed control in these plots. This is because these plots also consistently showed lower weed density and biomass. Similar weed control effectiveness and subsequent increase in yield had been reported by res-

earchers in which the net economic return from chemical weed control was higher than those of hand weeding (Chirita, 1987: Akinyemiju and Alimi, 1989).

CONCLUSION

Though comparable weed management effectiveness and yield were obtained in the hand weeded plots (3 and 8WAT) and Diuron + hand weeded plots, it may be recommended that Diuron with a supplementary hand weeding at 8 WAT be employed as an effective weed management programme in the study area.

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