Effect of Intercropping, Planting Date and Cultivars on Management of Sorghum [*Sorghum bicolor* L. (Moench)] Anthracnose in South West Nigeria

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Abstract: The reactions to anthracnose infection, caused by *Colletotrichum graminicola* (Cesati) Wilson, of sorghum [*Sorghum bicolor* L. (Moench)] cultivars intercropped with melon and planted at different dates in two Nigerian locations (Alabata and Maya), were studied in this research work. The locations represented two different agro-ecological zones of South West Nigeria, savanna and rainforest, respectively. The experimental trial was laid out in split-split plots, arranged in a randomized complete block design with three replications for each location. The main plot treatments consisted of two cropping systems (monocropping and intercropping), the sub-plot were three sorghum cultivars (ICSV 902 NG, Eyinfun and Ex-Minna), and sub-sub plot treatments consisted of different planting dates across seasons (2003, 2004, 2006 and 2007). The results obtained showed that sorghum/melon intercrop had no significant effect on anthracnose incidence/severity and grain yield. However, intercropped melon which did not exhibit the symptom of anthracnose had significantly lower seed yield than the sole crop. In all cases, ICSV 902 NG had the highest disease incidence and severity, while Ex-Minna and Eyinfun had the lowest disease ratings at Alabata in the years 2004 and 2006, and at Maya in 2007. Disease incidence was highest on sorghum cultivars planted at Alabata in the years 2003, 2004 and 2006 (mid-August), and at Maya in 2003 and 2004. Sorghum planted in late-August had disease incidence, severity score and grain yield of 43.3%, 3.5 and 1.32 t/ha respectively, with corresponding values of 37%, 3.3 and 1.3 t/ha for mid-September planting. Early planting of medium maturing sorghum cultivars in mid-August which appeared to increase anthracnose incidence/severity may reduce sorghum grain yield. This study revealed that the medium-maturing cultivars Ex-Minna and Eyinfun could be planted between August 28th and September 14th for maximum grain yield, while other control measures may not be necessary.

Key words: Agronomic practice, disease management, sorghum anthracnose, South West Nigeria.

1. Introduction

The sorghum [*Sorghum bicolor* L. (Moench)] cultivation in South West Nigeria falls between April and October, which is always accompanied with high relative humidity [1]. The atmospheric conditions of this period are favourable for the multiplication and dissemination of several plant pathogenic fungi. The sorghum crops were often attacked by various pathogens, which considerably reduce their

photosynthetic surfaces. This will definitely affect the quality and quantity of the grains produced by these crops. The foliar diseases are the major constraint to sorghum production in Nigeria [2, 3]. The sorghum anthracnose, caused by the fungus *Colletotrichum graminicola* (Cesati) Wilson, is considered a serious foliar disease in Nigeria [4] affecting the traditional and improved sorghum varieties, and it is reported to cause 30%-50% yield loss in susceptible cultivars [5, 6]. The use of resistant cultivars is the most important control strategy of sorghum anthracnose, but it is hampered because of the wide genetic variability of *C.*

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graminicola populations [7]. In fact, anthracnose-resistant cultivar in one region may be susceptible when taken to other region as a result of pathogen variability [8]. A large number of resistant cultivars are now available, and several of them have been used to produce commercial hybrid in USA and India. However, the stability and durability of this resistance is short lived.

In West Africa, many local land races and introduced varieties lack satisfactory resistance to sorghum anthracnose [6]. The intercropping system has been observed to provide sustainable yield over sole cropping. However, the positive effects on disease incidence/severity have been inconsistent. The use of different planting date has been observed to reduce or delay the development of anthracnose diseases [9]. Despite its increasing importance, the planting date is a useful agronomic practice that has not received the desired attention in this region. Moreover, there is little information available on the effects of planting date on sorghum anthracnose using the newly introduced medium-maturing sorghum cultivars in South West Nigeria. The farmers usually plant sorghum crops in mixtures with melon (*Cucumis melo* L.). Detailed studies have to be performed to assess the effect of planting date, under monocrop and intercrop systems, on sorghum anthracnose.

This paper reports the results of a study conducted to evaluate the effects of intercropping medium-maturing sorghum cultivars, planted at different dates and in two agro-ecological zones of South West Nigeria, on management of sorghum anthracnose.

2. Materials and Methods

2.1 Experimental Locations

The field experiments were carried out in two different locations: 1) University of Agriculture Permanent Site, Alabata, Abeokuta, Ogun State, Nigeria, Africa (Latitude 7°0' N and Longitude 3°23' E); 2) On-Farm Adaptive Research (OFAR) Field of

Agricultural Media Resources and Extension Centre (AMREC), Maya, Ibarapa East Local Government, Oyo State, Nigeria, Africa (Latitude 7°30' N, Longitude 3°20' E). The former represented savanna, while the latter fell into rainforest agro-ecological zones of South West Nigeria.

2.2 Assessment of Sorghum Cultivars Intercropped with Melon at Different Planting Dates to Anthracnose Infection

The experiments were carried out in the years 2003 and 2004 at Alabata and Maya locations, and then repeated in the 2006 at Alabata and in 2007 at Maya. It aimed to find out if cross infection of *C. graminicola* between the component crops occurred and at which growth stage. The experimental trials were laid out in split-split plot design in randomized complete block with three replications for each location. The main plot treatments consisted of two cropping systems (monocropping and intercropping), the sub-plot were three sorghum cultivars (a susceptible cultivar-ICSV 902 NG, V₁; moderately resistant Eyinfun, V₂ and Ex-Minna, V₃). The panicles of the cultivars Ex-Minna and ICSV 902 NG were shown in Fig. 1. The sub-sub plot treatments consisted of three planting dates at fourteen days interval (16th, 30th August and 14th September), indicated as mid-August, late-August and mid-September respectively. These planting dates were used in the four years of study (2003, 2004, 2006 and 2007).

Sorghum seeds were planted on ridges spaced 1.0 m apart and 0.3 m within row, melon seeds (cultivar T₀139) were planted 1.0 m apart on ridges and rows surrounded by a border row of 1.0 m. Six ridges of 6.0 m length constituted a plot while the four inner ridges of the same length made up the net plot. An area of 2,375 m² was used for each location, while sorghum/melon cultivars were planted at three stands per hole. The seedlings were thinned to two plants per stand three weeks after planting under rain-fed condition.

(a)

(b)

Fig. 1 Panicle of sorghum cultivars Ex-Minna (a) and ICSV 902 NG (b).

The fertilizers were applied to sorghum at the rate of 60 kg N, 30 kg P_2O_5 and 30 kg K_2O /ha, respectively. Half of the N and all the P and K were applied as compound fertilizer (N:P:K 15:15:15) three weeks after planting. The remaining N was applied as top-dressed urea at nine weeks after planting. The fields were hand-weeded at three and seven weeks after planting and ridges remoulded at nine weeks after planting under rainfed condition.

Observations were taken on the percentage seedling

emergence, and arrival time of the first anthracnose disease symptom was recorded by method proposed by Williams (1978) [10]. Stand count prior to disease scoring, incidence and severity of disease, were taken at physiologic maturity as well as the grain yield.

2.3 Disease Assessment

Sorghum anthracnose disease symptoms were assessed on whole plant on the basis of physiological maturity in the different locations (109 days for Alabata and 106 days for Maya).

The disease incidence and severity parameters were expressed in percentage and evaluated by method proposed by Hess (1999) [11] and Thakur (1995) [5], using the following visual rating scale:

Disease Rating	Severity of infection
1	= no symptoms on leaf surface
2	= 1-5% of total leaf area damaged
3	= 6-10% of total leaf area damaged
4	= 11-20% of total leaf area damaged
5	= 21-30% of total leaf area damaged
6	= 31-40% of total leaf area damaged
7	= 41-50% of total leaf area damaged
8	= 51-75% of total leaf area damaged
9	= >75% of total leaf area damaged

2.4 Yield Assessment

Sorghum grains, fully matured and dried, were harvested and yield assessed from the four inner rows of each plot. Harvesting was done manually using cutlass. Plants were cut at their base, placed in their respective plots and allowed to dry. The panicles were then threshed and the total grain obtained from each plot were weighed and converted to ton per hectare.

Melon fruits were gathered when the vines were brittle dry. Fruits were broken with wooden clubs and heaped for 7 days to ferment. Seeds were extracted from the soft pulp and washed in a basket with running water and seeds left to dry. The dry seeds were weighed after sun-drying to constant weight.

2.5 Data Analysis

The data collected were statistically analyzed with MSTAT-C. Mean comparisons were carried out using Duncan's Multiple Range (DMR) Test.

Percentage data were transformed in arcsine before the analysis. The means of treatments were separated at 5% probability level ($P \leq 0.05$).

3. Results

Sorghum stand counts' results were not significantly different across the locations and planting dates. Intercropping had no significant effect on the time of first appearance of anthracnose on sorghum cultivars at the two locations, but different cultivars and planting dates significantly influenced the time of first disease symptoms appearance.

A significant reduction of the anthracnose incidence and severity among the cultivars, across the three planting dates of sorghum at the two locations, were observed.

Sorghum grain yield varied among cultivars and it was significantly affected by planting dates of sorghum in 2003 and 2004, at both Maya and Alabata, and in 2006 at Alabata.

3.1 Time of First Appearance of Anthracnose Symptoms on Three Sorghum Cultivars Intercropped with Melon

The times of first appearance of anthracnose were presented in Table 1.

Types of sorghum variety did not significantly influence the days of first appearance of anthracnose symptoms in 2003 at Alabata. However, the appearance of the disease came early by 5 days in 2004 and 7 days in 2006 in ICSV 902 NG, compared to Eyinfun and Ex-Minna. The similar trend was observed at Maya, where ICSV 902 NG significantly showed the symptom early, while the disease symptom was observed late in Eyinfun during 2003-2007 and Ex-Minna in 2007.

Effect of different planting date on the first appearance of anthracnose was not significant in 2003

at Alabata. However, sorghum planted in mid-August 2004 showed the first disease symptom, while those planted in mid-September 2007 at Maya expressed the late disease symptom. The appearance was soonest in 2003 and disease severity obtained showed that Eyinfun and Ex-Minna had the least disease severity that was not significantly different from each other.

At Maya, disease incidence early observed in mid-August, was significantly earlier than on sorghum planted in mid-September in the years 2003 and 2004 (Table 1). The results were not significantly different among the cultivars planted in mid-September 2003 in the same location. However, disease severity was lowest in 2004 on cultivars planted in mid-September. The results obtained at this location in the 2007 were significantly different from one another. The disease severity was highest in sorghum cultivars planted in mid-September, while the sorghum cultivars planted in late-August had disease severity that was significantly different from those cultivars planted in mid-August in the same year. However, in the 2007, the time of first appearance of anthracnose was earliest in sorghum planted in mid-September and latest in sorghum planted in mid-August.

3.2 Anthracnose Incidence on Three Sorghum Cultivars Intercropped with Melon

The anthracnose incidence data were shown in Table 2.

In the years 2003, 2004 and 2006, disease incidence was significantly higher in ICSV 902 NG, while it was lower in Eyinfun and Ex-Minna in 2004, 2006 and 2007 at Alabata and Maya respectively. The disease incidence of Eyinfun and Ex-Minna was not significantly different in 2004 and 2006 at Alabata, and in 2007 at Maya. However, in 2003 Ex-Minna had the disease incidence that differed significantly from Eyinfun at Alabata. While, in 2003 Eyinfun had the lowest disease incidence that was significantly different from Ex-Minna at Maya.

Table 1 Time of first appearance of anthracnose on three sorghum cultivars at three different planting dates in two locations.

	First appearance of disease symptom (days)					
	Alabata			Maya		
	2003	2004	2006	2003	2004	2007
Cultivars						
ICSV 902 NG	65a	64.5b	63.72b	65.33c	64.61b	56.17b
Eyinfun	70a	70.a	70.28a	70.33a	70.22a	67.21a
Ex-Minna	68a	69.72a	70.22a	67.72b	69.78b	67.33a
Mean	67.67	68.07	68.07	67.79	68.2	63.57
Planting Date						
Mid-August	68a	67.5b	67.61b	67.39b	67.89b	65a
Late-August	69a	68.17ab	67.94b	67.67b	68.17ab	64.39a
Mid-September	68a	68.56a	68.67a	68.33a	68.56a	61.32b
Mean	68.33	68.08	68.07	68.08	68.21	63.57

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

Table 2 Anthracnose incidence on three sorghum cultivars at three different planting dates in two locations.

	Disease incidence (%)					
	Alabata			Maya		
	2003	2004	2006	2003	2004	2007
Cultivars						
ICSV 902 NG	65.16a	66.04a	72.13a	65.47a	65.12a	83.88a
Eyinfun	33.71b	32.46b	37.26b	21.83c	30.73c	37.88b
Ex-Minna	31.48c	31.82b	36.7b	22.6b	31.62b	37.95b
Mean	43.45	43.44	48.7	36.63	42.52	53.24
Planting Date						
Mid-August	46.73a	47.18a	51.03a	39.93a	46.69a	51.6b
Late-August	43.13b	42.95b	48.84b	36.43b	41.97b	51.4b
Mid-September	40.48c	40.19c	46.22c	33.64c	38.81c	56.72a
Mean	43.45	43.44	48.7	36.69	42.49	53.24

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

The planting date had significant effect on the disease incidence in both locations. Sorghum cultivars planted in mid-August had the higher disease incidence in 2003 and 2004, while sorghum cultivars planted in mid-September had the least disease incidence. However, the sorghum cultivars planted in mid-September were highly affected by the disease in 2007 at Maya. Low incidence of anthracnose was observed in sorghum cultivars planted in mid-August in the same year and location tested.

3.3 Anthracnose Severity on Three Sorghum Cultivars Intercropped with Melon

The anthracnose severity data were presented in

Table 3.

Cultivar ICSV 902 NG had the highest disease severity, ranging from 5.7 to 6.2, which was significantly greater than that of Eyinfun and Ex-minna (2003, 2004, 2006 and 2007), whose disease severity values were not significantly different across the years and locations. In 2003, planting date had no significant effect on disease severity in both locations. However, the sorghum planted in mid-August significantly had higher disease severity than sorghum cultivars planted in mid-September in 2004 at both locations, in late-August and mid-September 2006 at Alabata and in late-August 2007 at Maya.

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Table 3 Anthracnose severity on three sorghum cultivars at three different planting dates in two locations.

	Disease severity (%)					
	Alabata			Maya		
	2003	2004	2006	2003	2004	2007
Cultivars						
ICSV 902 NG	5.8a	5.8a	6.1a	5.7a	5.7a	6.2a
Eyinfun	2.4b	2.1b	2.7b	2.2b	2.1b	2.8b
Ex-Minna	2.4b	2.1b	2.5b	2.3b	2.2b	2.7b
Mean	3.5	3.3	3.8	3.4	3.3	3.9
Planting Date						
Mid-August	3.6a	3.5a	4.1a	3.4a	3.6a	3.9b
Late-August	3.6a	3.3ab	3.8b	3.5a	3.4a	3.6c
Mid-September	3.4a	3.1b	3.5c	3.3a	3.1b	4.2a
Mean	3.5	3.3	3.8	3.4	3.4	3.9

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

The disease severity was highest in sorghum cultivars planted in mid-August 2003 and 2004 at both locations, and in 2006 at Alabata. This was closely followed by the sorghum cultivars planted in late-August and mid-September 2003 at the location, while sorghum cultivars planted in mid-September 2006 had the least anthracnose disease severity in Alabata. Sorghum cultivars planted in late-August and mid-September 2004 at Maya were not significantly different from each other.

The disease severity in the periods mentioned above was not significantly different from sorghum cultivars planted in late-August in the same year. ICSV 902 NG had the highest disease severity. However, disease

severity was lowest on sorghum cultivars planted in mid-September 2004. The disease severity was highest in sorghum cultivars planted in mid-September, if compared with those planted in late-August had low disease severity and was significantly different from those planted in mid-August in the same year.

3.4 Grain Yield of Three Sorghum Cultivars Intercropped with Melon

The results on the grain yield of sorghum cultivars were shown in the Tables 4-6.

Cultivar Ex-Minna produced significantly higher grain yield (Table 4) across the years at the two locations.

Table 4 Grain yield of three sorghum cultivars at three different planting dates in two locations.

	Grain yield (t/ha)					
	Alabata			Maya		
	2003	2004	2006	2003	2004	2007
Cultivars						
ICSV 902 NG	0.91c	0.91c	0.94b	0.91c	0.9b	0.92c
Eyinfun	1.39b	1.24b	1.31a	1.38b	1.26a	1.28 b
Ex-Minna	1.58a	1.27a	1.33a	1.58a	1.3a	1.38a
Mean	1.29	1.14	1.19	1.29	1.15	1.19
Planting Date						
Mid- August	1.3a	1.12b	1.18b	1.29b	1.13b	1.17a
Late-August	1.3a	1.19a	1.23a	1.3a	1.2a	1.19a
Mid-September	1.28a	1.12b	1.17b	1.27c	1.15b	1.2a
Mean	1.31	1.14	1.19	1.29	1.16	1.19

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

Table 5 Interaction between the sorghum cultivar and planting date on disease incidence/severity and grain yield during the year 2003.

	Alabata	Maya
Mid-August	Disease incidence (%)	
ICSV 902 NG	65.7a	66.7b
Eyinfun	38.2b	26.4d
Ex-Minna	36.3c	26.6d
Late-August		
ICSV 902 NG	64.9a	65.9b
Eyinfun	32.9d	20.6f
Ex-Minna	31.6de	22.8e
Mid-September		
ICSV 902 NG	64.9a	63.7c
Eyinfun	30e	18.5g
Ex-Minna	26.5f	18.4g
Mid-August	Disease severity (%)	
ICSV 902 NG	5.7b	5.8a
Eyinfun	2.7c	2.4d
Ex-Minna	2.7c	2.6c
Late-August		
ICSV 902 NG	6.1a	5.7b
Eyinfun	2.3d	2.2de
Ex-Minna	2.6c	2.2e
Mid-September		
ICSV 902 NG	5.8b	5.7b
Eyinfun	2.1e	2f
Ex-Minna	2e	2.1ef
Mid-August	Grain yield (t/ha)	
ICSV 902 NG	0.899h	0.905h
Eyinfun	1.386e	1.386e
Ex-Minna	1.585b	1.584b
Late-August		
ICSV 902 NG	0.92g	0.916g
Eyinfun	1.396d	1.398d
Ex-Minna	1.594a	1.597a
Mid-September		
ICSV 902 NG	0.893h	0.895i
Eyinfun	1.372f	1.371f
Ex-Minna	1.573c	1.578c

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

However, Eyinfun and Ex-Minna significantly produced the highest grain yield in 2004 at Maya and in 2006 at Alabata, which did not statistically differ from each other. ICSV 902 NG had the lowest grain yield during the years at both locations. In Alabata and Maya, planting date had significant effect on sorghum grain yield. With the exception of 2003 at Alabata and 2007 at Maya, sorghum cultivars planted in late-August significantly produced higher grain yields

Table 6 Interaction between the sorghum cultivar and planting date on disease incidence/severity and grain yield during the year 2004.

	Alabata	Maya
Mid-August	Disease incidence (%)	
ICSV 902 NG	63.95b	63.9b
Eyinfun	37.9d	37.8c
Ex-Minna	37.7d	38.4c
Late-August		
ICSV 902 NG	68a	67.1a
Eyinfun	31.1e	28.3e
Ex-Minna	29.8ef	30.5f
Mid-September		
ICSV 902 NG	64.2c	64.36b
Eyinfun	28.4f	26.1f
Ex-Minna	27.9g	26f
Mid-August	Disease severity (%)	
ICSV 902 NG	5.5b	5.6b
Eyinfun	2.5c	2.37d
Ex-Minna	2.6c	2.5c
Late-August		
ICSV 902 NG	6a	6.1a
Eyinfun	2d	2.22de
Ex-Minna	1.9d	2.2de
Mid-September		
ICSV 902 NG	5.7b	5.8b
Eyinfun	1.9d	2e
Ex-Minna	1.8de	2.1e
Mid-August	Grain yield (t/ha)	
ICSV 902 NG	0.877g	0.857g
Eyinfun	1.225cd	1.236b
Ex-Minna	1.28b	1.289b
Late-August		
ICSV 902 NG	0.953e	0.957e
Eyinfun	1.292b	1.303d
Ex-Minna	1.325a	1.351a
Mid-September		
ICSV 902 NG	0.909f	0.92f
Eyinfun	1.206d	1.248cd
Ex-Minna	1.236c	1.268c

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

than other cultivars planted in mid-August or mid-September (Table 4).

Interaction of variety by planting date of sorghum had significantly greater effect on the disease incidence/severity and sorghum grain yield (Tables 5 and 6). Variety by planting dates interaction was significant suggesting that planting date has greater influence on the performance of sorghum cultivars in relation to disease reaction as well as grain yield.

On the intercropping system, the tables showed that the interaction effects between (1) cropping system and cultivar, (2) cropping system and planting date, (3) cropping system and variety and planting date were not significant on the disease incidence/severity and sorghum grain yield at Alabata and Maya.

3.5 Yields of Melon During the Years 2003-2006

The effects of sorghum/melon intercropping and planting date on melon yields in Alabata and Maya in the years 2003-2006 were presented in Table 7.

The results showed that the melon seed yield, which ranged between 0.65 and 0.79 t/ha at Maya and Alabata, was significantly higher in melon monoculture planted in mid-September across the period, in both locations. Melon crops intercropped with sorghum crops at mid-September, had a seed yield variability (ranging from 0.59 to 0.71 t/ha). However, the least seed yield was obtained when melon was planted in mid-August and late-August in both sole and intercropping systems at the locations tested.

4. Discussion and Conclusions

Intercropping, a common agronomic practice

usually used in the disease management as a control strategy, did not significantly reduce the sorghum anthracnose incidence/severity in the two Nigerian locations tested in this work. The results suggest that intercropping has to be combined with other methods for effective anthracnose management.

In the year 2003, sorghum cultivars planted in mid-August had the highest disease incidence, while sorghum planted in mid-September had lower disease incidence than sorghum planted in late-August. This might be due to high relative humidity in August, as a result of rainfall [12]. The late-August planting had higher sorghum grain yield at both locations than mid-August and mid-September planting, that were not different in 2004 in the cropping season. This might be as a result of the heading of sorghum coinciding with dry season. However, the results obtained in the year 2007 at Maya locality varied significantly compared with the earlier ones, where sorghum cultivars planted in mid-September gave the highest grain yield that was different from other planting dates. There was a significant interaction between cultivars and planting date, suggesting that the planting date of sorghum has major influence of

Table 7 Yields of melon (cultivar T₀139) in monoculture and in mixtures with three sorghum cultivars in the years 2003-2006.

	Planting date	Melon seed yield (t/ha)			
		Alabata			Maya
		2003	2004	2006	2004
Melon Intercrop					
	ICSV 902 NG Mid-August	0.55d	0.53d	0.64d	0.57d
	Late-August	0.59bc	0.55c	0.66c	0.59c
	Mid-September	0.6b	0.59b	0.71b	0.61b
Eyinfun					
	Mid-August	0.54d	0.54cd	0.63d	0.59de
	Late-August	0.59bc	0.58b	0.69c	0.59c
	Mid-September	0.6b	0.59b	0.74b	0.61bc
Ex-Minna					
	Mid-August	0.55d	0.55c	0.63d	0.56c
	Late-August	0.59bc	0.59b	0.7c	0.59c
	Mid-September	0.61b	0.6b	0.73b	0.61b
Sole melon					
	Mid-August	0.59c	0.58b	0.73b	0.59c
	Late-August	0.58c	0.59b	0.73b	0.59c
	Mid-September	0.65a	0.65a	0.79a	0.66a

Means followed by the same letter are not significantly different, according to DMR Test ($P \leq 0.05$).

the sorghum cultivars on the disease incidence and grain yield.

The melon planted did not express any anthracnose symptom. The cultivar selected could be anthracnose resistant as there was no trace of cross infection of the pathogen from sorghum plant under intercropping system and also from melon to sorghum. This finding is also confirmed by studies conducted by Ozolua (1981) [13].

It was observed that melon yield was lower in intercropping than in sole cropping. Melon yield was significantly reduced by intercropping sorghum with melon. The reduction may be attributed to the differences in the morphology of the crops, where melon is being shaded by taller sorghum in mixture. It was observed that sole melon planted in mid-September produced the highest melon seed yield at the locations during 2003, 2004 and 2006, while melon inter-planted with sorghum in mid-August had the lowest yield of melon. The land usage has been maximized through planting of melon in sorghum production with an added advantage of melon yield in mixture over sole sorghum. It is better to plant by mid-September in sorghum/melon intercropping systems.

Therefore, this study suggested that the medium-maturing cultivars Ex-Minna and Eyinfun could be planted between August 28th and September 14th for less disease incidence and better grain yield. These planting dates might make other control measures not necessary.

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