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THE EFFECTS OF PLANTING DATES ON SEVEN VARIETIES OF SOYBEAN IN UMUDIKE AGROECOSYSTEM OF SOUTH EASTERN NIGERIA

D. A, Okpara*, T. O. Ojikpong, And A. A Udo
College of Crop and Soil Sciences
Michael Okpara University of Agriculture, Umudike Umuahia
Abia State

+ CORRESPONDING AUTHOR

ABSTRACT

Field plot experiments were conducted in Umudike agroecosystem of south eastern Nigeria in 2002, 2003 and 2004 cropping seasons to study the effects of planting dates on seven varieties of soybean. In each year, the experiment was laid out as split plot in randomized complete block design with three replicates. The main plot treatments were four planting dates (June, July, August and September) and sub plot treatments were seven varieties (TGX 1485-1D, TGX 1440-1E, TGX 1799-8F, TGX 1831-32F, TGX 1740-2F, TGX 1878-7E and NCRI SOY-1). Planting in July and August resulted in significant increases in number of nodules per plant, number of pods per plant, 100-seed weight and seed yield, on average. Soybean TGX 1485-1D was the earliest to flower and produced significantly higher 100-seed weight and seed yield than other varieties, except TGX 1799-8F.

INTRODUCTION

Soybean (Glycine max (L.) Merrill) is an important crop in Nigeria. Soybean produces high quality oil, about 20 percent of its content, and protein, about 40 percent of the bean (Singh *et al.*, 1987). The oil is highly digestible, high in unsaturated fatty acids and contains no cholesterol. Its protein is superior, with substantial levels of most essential amino acids. Soybean is a cheap substitute for meat and fish when consumed with a cereal to supply methionine and cystine, (Singh et al., 1987).

Planting dates and varieties are very important determinants of growth and yield in soybean in any environment (Pal*et al.*, 1983; Bello *et al.*, 1996). Howell (1963) also noted that since the variabilities in soybean performance could be accounted for by variations in the components of the environment, there would always be the need for genotype-environment interaction studies, especially as new cultivars are continually developed through breeding by the International Institute of Tropical Agriculture (IITA), Ibadan and National Cereals Research Institute (NCRI), Badeggi. Though mainly short day plants, soybeans are very photoperiodic sensitive and cultivars are known to differ markedly with respect to the minimum dark period required to induce flowering (Onwueme and Sinha, 1991).

Extensive testing is therefore required to

identify genotypes that show the least interaction with environments, or possess the greatest stability of performance. The cheaper alternative is the unilocational evaluation under different micro-environmental conditions created by varying planting dates (Bello *et al.*, 1996). Soybean response to planting dates also varies with locations within an agroecological zone as separately reported by Ndon et al. (1997) and Oko et al. (1991) for locations in Uyo and Calabar respectively. These two locations are within the same southeast agroecological zone of Nigeria. Earlier studies in the Umudike agroecosystem of the Southeast agroecological zone on soybean adaptability and fertility trials (Okpara and Ibiam, 2000; Okpara et al. 2002) could not provide information on the optimum time of planting for the crop. The objective of this study was therefore to determine the optimum planting date for soybean varieties of different maturity ratings in Umudike agro-ecosystem of southeastern Nigeria.

MATERIALS AND METHODS

The study was conducted under rainfed conditions in 2002, 2003 and 2004 at Michael Okpara University of Agriculture, Umudike, research farm situated at longitude 070 331E, latitude 050 291N with altitude of 122m above sea level. The soil is classified as an ultisol. Some of the soil characteristics and meteorological data are summarized in Tables1 and2

The 2002 and 2003 experiments were planted on the same field plots while the 2004 experiment was conducted at a site about 1000m from that of 2002 and 2003. The land used was cleared, ploughed, harrowed and sampled for analysis in 2002 and 2004. The experiment was a split plot laid out in a randomized complete block design (RCBD) with three replications. The main plot treatments were four planting dates while the subplot treatments were seven varieties of soybean. The four planting dates were 7 June, 7 July, 6 August and 5 September in 2002; 9 June, 11 July, 11 August and 12 September in 2003 and 11 June, 12 July, 10 August and 8 September in 2004. The seven soybean varieties were the early TGX 1485-1D, TGX 1799-8F, TGX 1831-32F and TGX 1740-2F and the medium TGX 1440-1E, TGX 1878-7E and NCRI Soy-1. Each plot measured 3 m x 3 m.

Soybean seeds were sown at a spacing of 5 cm along the crest of ridges made 50 cm apart in appropriate plots to give a plant population of 400,000 plants/ha. One seed was planted per hole and supply at vacant stands was done at 2 weeks after planting (WAP). Compound fertilizer 12:12:17:2 NPK Mg was applied at the rate of 416kg/ha (50kgN/ha) (Okpara et al., 2002). The crop was protected against insect pests in 2002 and 2003 by spraying with cypermethtrin diluted at 5ml in 1L water at 2 and 4 WAP. Weeding was done by hand hoeing at 3, 6 and 9 WAP.

Soil pH was measured in 1:2.5 Soil: water. Total N in soil was analysed by the kjeldahl method. Total soil P was determined by the Bray 1 method. K was determined by flame photometry.

Data were taken on plant height (cm) and shoot dry matter (g/plant) at 6 WAP from four plants per plot and days to 50% flowering. At full maturity, data were taken

on number of nodules per plant, number of pods per plant, number of seeds per pod, 100-seed weight (g) and seed yield (kg/ha). The data obtained were subjected to analysis of variance (ANOVA) and significant differences among treatment means detected using Fisher's least significant difference (Gomez andGomez, 1984)

RESULTS

The soil properties summarized in Table 1 indicate that soil texture for the 2002 and 2003 experiment was loamy sand while that for the 2004 experiment was sandy loam.

Organic matter, soil N, P and K were higher in the soil used for 2004 experiment. Total rainfall for the experimental period of June to November were 1477.4, 1736.3 and 1519.7mm in 2002, 2003 and 2004, respectively (Table 2). Monthly rainfall was particularly high at over 400mm in July, 2003 while temperature for the three years was relatively low in July through September The effects of planting date and variety on number of nodules per plant and plant height are presented in Table 3. The number of nodules produced per plant was significantly higher in July and August than in June and September planting dates. Soybean TGX 1878-7E and TGX 1440-1E produced significantly higher number of nodules per plant than other varieties. Interactions were significant, with TGX 1440-1E producing

significantly higher number of nodules in July compared with other varieties across all planting dates.

Plant height at 6WAP did not statistically vary among the planting dates. On the other hand, TGX 1831-32F gave significantly taller plants than NCRI- Soy-1, which also had higher plant height than other varieties. Effects of planting date and variety interactions were not significant (Table 3).

Data on dry weight of shoot and days to 50% flowering are shown in Table 4. Soybean TGX 1485-1D gave significantly higher dry matter of shoot than TGX 1799-8F and TGX 1740 but not other varieties. Planting date and interactions between planting date and variety did not influence the accumulation of dry matter in the shoot at 6 WAP

The number of days to 50% flowering was significantly reduced in August than in other planting dates. Soybean plants sown in July and September flowered earlier than plants sown in June. TGX 1485-1D and TGX 1831-32F flowered significantly earlier than TGX 1799-8f and TGX 1740-2F, which also flowered earlier than TGX 1878-7E, TGX 1440-1E and NCRI Soy-1. Interactions were significant, with earliest flowering (36 days) occurring in TGX 1485-1D and TGX 1799-8F in August planting while the highest number of days to flowering (59 days) occurred in NCRI Soy-1 in June planting date.

Table 1: Soil properties of the sites and monthly rainfall for the experimental periods

	2002	2003	2004
Mechanical properties of soil			
Sand(%)	85		69.8
Clay(%)	8		10.8
Silt(%)	7		19.4
Texture class	Loamy sand		Sandy loam
Chemical properties of soil			
OM(%)	1.91		2.66
N(%)	0.05		0.15
P(Ppm)	27		74
K(mm/100g)	0.05		1.3
pH	5.25		5.45

Table 2: Meteorological Information of Umudike (the study area)

Weather information		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Rain fall (mm)														
2002		3.1	107.1	68.5	259.0	436.3	240.1(16)	359.8(23)	333.7(21)	238.5(18)	248.5(18)	57.8(5)	0.0	2352.4
2003		0.0	37.9	119.5	159.8	231.4	282.4(18)	447.5(26)	372.6(19)	340.8(20)	180.2(13)	69.2(5)	0.0	2241.3
2004		0.2	11.9	22.4	134.5	217.6	279.4(18)	309.5(18)	304.3(12)	324.9(19)	249.1(16)	52.5(4)	5.1(1)	1911.4
Temperature(°C)														
2002	Max.	32	34	33	32	32	30	30	28	29	30	32	33	
	Min.	21	22	24	24	24	23	23	23	22	22	23	21	
2003	Max.	33	33	34	34	32	31	30	29	30	31	32	32	
	Min.	22	24	24	24	23	23	23	23	22	23	23	20	
2004	Max.	33	35	36	32	32	30	29	30	31	33	33	33	
	Min.	21	23	24	26	22	22	22	22	23	22	22	21	
Sunshine (Hrs)														
2002		4.8	6.3	4.0	3.9	5.9	5.1	3.8	2.1	3.2	2.8	5.0	5.7	
2003		5.5	5.3	4.1	6.5	4.9	3.9	3.0	2.6	2.3	2.3	4.4	4.2	
2004		2.4	4.8	4.0	4.6	5.7	4.1	3.6	1.7	3.2	5.0	4.8	5.6	

* Values in bracket indicate number of rainy days

Table 3: Effect of planting date on number of nodules per plant at 12 WAP and plant height at 6 WAP of seven varieties of soybean

	Planting Date				
Variety	**June**	**July**	**August**	**September**	**Mean**
Number of nodules/plant					
TGX 1485 –ID	2.2	3.3	6.2	1.8	3.4
TGX 1440-IE	4.7	15.1	6.5	1.2	6.9
TGX 1799-8F	1.3	3.6	5.7	5.6	4.1
NCR Soy-I	2.1	4.1	4.2	2.8	3.3
TGX 1831-32F	2.5	3.7	3.2	2.9	3.1
TGX 1878-7E	3.5	10.6	8.1	8.2	7.6
TGX 1740-2F	2.6	4.8	11.1	2.8	5.3
Mean	2.7	6.5	6.4	3.6	
Plant height (cm)					
TGX 1485-ID	23.9	29.4	32.3	32.0	29.4
TGX 1440-IE	23.2	32.8	32.7	29.0	29.4
TGX 1799-8F	19.7	33.5	35.8	28.9	29.5
NCRI Soy –I	24.2	37.6	32.6	36.9	32.8
TGX 1831-32F	39.4	40.8	36.1	38.2	38.6
TGX 1878 –7E	23.7	32.7	30.0	28.5	28.7
TGX 1740 2F	23.9	24.8	24.7	27.1	25.1
Mean	25.4	33.1	32.0	31.5	
	Number of nodules	Plant height			
LSD (0.05) for planting date (D) means=	1.4	NS			
LSD (0.05) for variety (V) means=	1.9	5.6			
LSD (0.05) for D x V means=	3.7	NS			

Variety	June	July	August	September	Mean
		Shoot dry weight (g/plant)			
TGX 1485-ID	1.3	1.7	2.1	1.6	1.7
TGX 1440-IE	1.7	1.7	1.5	1.3	1.5
TGX 1799-8F	0.6	1.4	1.7	1.3	1.2
NCR Soy-I	1.1	1.7	1.8	1.7	1.6
TGX 1831-32F	1.1	2.0	1.5	1.6	1.5
TGX 1878 –7E	1.4	1.7	1.6	1.3	1.5
TGX 1740-2F	1.3	0.7	1.0	1.0	1.0
Mean	1.2	1.6	1.6	1.4	
		Days to 50% flowering			
TGX 1485-ID	47.3	45.0	36.0	43.0	42.8
TGX 1440-IE	55.0	49.0	46.0	50.0	50.0
TGX 1799-8F	54.0	44.0	36.0	47.7	45.4
NCRI Soy-I	58.7	51.3	47.0	50.0	51.8
TGX 1831-32F	47.0	44.0	40.0	43.0	43.5
TGX 1878 – 7E	54.0	52.3	42.0	50.0	49.6
TGX 1740 –2F	47.3	42.0	42.0	50.0	45.3
Mean	51.9	46.8	41.3	47.7	
	Shoot dry weight	Days to 50% flowering			
LSD (0.05) for planting date (D) means=	NS	1.3			
LSD (0.05) for variety (V) means=	0.4	1.3			
LSD (0.05) for D X V means=	NS	2.5			

At harvest, the number of pods per plant increased significantly with delay in planting up to July or August, especially in 2002 and 2004 (Table 5). On average, TGX 1485-1D produced significantly more pods than other varieties in 2002 and 2003. There were significant interactions between planting date and variety on number of pods produced. Soybean TGX 1485-1D always produced the highest number of pods in August while NCRI Soy-1 had the least in September planting date. The number of seeds per pod was significantly higher in September than
other planting dates in 2002 (Table 6). In 2004, however, the number of seeds per pod was higher in July and August than in June and September plantings. TGX 1485-1D and NCRI soy-1 had more seeds per pod than TGX 1440-1E, TGX 1799-8F and TGX 1831-32F in 2002. Interactions were significant in 2003 only, with the highest number of seeds obtained with TGX 1440-1E variety in July planting date.

100-seed weight was significantly higher in August than in June and September planting dates in 2002 and 2003 (Table 7). While seed weight was higher in July than August in 2004 the reverse was true in 2003. Soybean TGX 1485-1D consistently and significantly gave higher seed weight than other varieties in the three years. Interactions were significant in 2003 and 2004. In 2003, highest seed weight occurred with TGX 1485-1D in August while in 2004, highest seed weight occurred mostly in TGX 1485-1D, TGX

Table 5: Effect of planting date on number of pods per plant of seven varieties of soybean in 2002, 2003 and 2004

Variety	Planting Date					Planting Date				
	June	July	Aug	Sept	Mean	June	July	Aug	Sept	Mean
			2002					2003		
TGX 1485 - ID	12.2	23.1	41.9	7.7	21.3	3.7	6.1	12.2	6.4	7.1
TGX 1440 - IE	9.6	8.8	7.3	5.4	7.8	3.1	1.9	6.8	5.2	4.3
TGX 1799 - 8F	10.5	9.4	11.5	4.0	8.9	4.3	3.2	7.2	8.0	5.7
NCR Soy - I	5.5	8.9	6.7	4.7	6.4	1.5	3.2	7.4	4.6	4.2
TGX 1831 – 32F	4.5	8.4	6.9	5.7	6.4	4.3	2.7	7.8	10.7	6.4
TGX 1878 - 7E	6.5	7.9	6.8	11.1	8.1	1.6	2.0	6.1	7.1	4.5
TGX 1740 – 2F	5.2	5.3	4.9	8.3	5.9	3.4	3.0	5.1	10.8	5.6
Mean	7.7	10.3	12.3	6.7		3.3	3.2	7.5	7.5	
			2004							
TGX 1485 – ID	10.2	25.9	41.1	11.7	22.2					
TGX 1440 – IE	11.1	29.3	35.3	8.3	21.0					
TGX 1799 – 8F	10.8	33.8	33.3	22.0	25.0					
NCR Soy – I	7.0	38.3	37.2	2.6	21.3					
TGX 1831 – 32F	7.7	29.8	20.8	22.8	20.3					
TGX 1878 – 7E	7.2	20.0	22.2	8.6	14.5					
TGX 1740 – 2F	6.0	21.4	33.0	17.0	19.4					
Mean	8.6	28.4	31.8	13.3						

	2002	2003	2004
LSD (0.05) for planting date (D) means=	3.7	1.5	5.2
LSD (0.05) for variety (V) means=	3.7	1.9	NS
LSD (0.05) for D x V means=	7.4	3.8	13.9

Table 6: Effect of planting date on number of seeds per pod of seven varieties of soybean in 2002, 2003 and 2004

Variety	Planting Date					Planting Date				
	June	July	Aug.	Sept.	Mean	June	July	Aug.	Sept.	Mean
			2002					2003		
TGX 1485 - ID	1.8	1.7	1.7	1.7	1.7	1.8	1.6	1.7	1.6	1.7
TGX 1440 - IE	1.6	1.5	1.4	1.9	1.6	1.4	1.9	1.1	1.7	1.5
TGX 1799 - 8F	1.8	1.7	1.6	1.9	1.8	1.5	1.4	1.5	1.6	1.5
NCR Soy - I	1.8	1.5	1.6	1.7	1.7	1.8	1.1	1.1	1.4	1.4
TGX 1831 – 32F	1.4	1.4	1.6	1.6	1.5	1.5	1.5	1.7	1.2	1.5
TGX 1878 - 7E	1.8	1.6	1.6	1.8	1.7	1.6	1.5	1.8	1.6	1.6
TGX 1740 – 2F	1.7	1.6	1.7	2.1	1.8	1.6	1.6	2.0	1.4	1.7
Mean	1.7	1.6	1.6	1.8		1.6	1.5	1.6	1.5	
			2004							
TGX 1485 – ID	1.8	2.6	2.7	2.9	2.5					
TGX 1440 – IE	1.5	2.2	2.1	1.7	1.9					
TGX 1799 – 8F	1.8	2.2	3.1	1.8	2.2					
NCR Soy – I	1.9	2.8	2.6	1.5	2.2					
TGX 1831 – 32F	1.6	2.3	3.4	2.2	2.4					
TGX 1878 – 7E	1.8	3.3	2.8	2.0	2.5					
TGX 1740 – 2F	1.8	2.4	3.0	1.5	2.2					
Mean	1.7	2.5	2.8	1.9						

	2002	2003	2004
LSD (0.05) for date (D) means	0.1	NS	0.4
LSD (0.05) for variety (V) means	0.2	NS	NS
LSD (0.05) for D x V means	NS	0.4	NS

Table 7: Effect of planting date on 100-seed weight (g) of seven varieties of soybean in 2002, 2003 and 2004

Variety	Planting Date					Planting Date				
	June	July	Aug.	Sept.	Mean	June	July	Aug.	Sept.	Mean
			2002					2003		
TGX 1485 - ID	9.4	10.3	10.3	8.9	9.7	9.3	8.8	11.7	5.5	8.8
TGX 1440 - IE	6.4	8.6	8.1	4.0	6.8	6.8	7.0	7.7	3.8	6.3
TGX 1799 - 8F	6.7	8.1	8.8	6.2	7.4	7.6	7.4	8.3	4.7	7.0
NCR Soy - I	7.6	8.5	8.4	7.6	8.0	6.9	8.3	6.1	2.1	5.9
TGX 1831 – 32F	8.9	8.7	9.2	7.9	8.7	7.9	8.9	8.8	4.0	7.4
TGX 1878 - 7E	7.0	8.1	8.6	5.2	7.2	7.7	6.8	7.9	2.4	6.2
TGX 1740 – 2F	7.7	8.9	9.1	6.3	8.0	8.0	7.6	9.5	3.5	7.2
Mean	7.7	8.7	8.9	6.6		7.7	7.8	8.6	3.2	
			2004							
TGX 1485 – ID	10.3	12.3	11.7	9.8	11.0					
TGX 1440 – IE	6.4	9.4	8.4	5.6	75.					
TGX 1799 – 8F	7.9	12.4	11.5	7.6	9.9					
NCR Soy – I	7.7	10.8	8.7	3.0	7.6					
TGX 1831 – 32F	9.3	12.5	11.4	8.5	10.4					
TGX 1878 – 7E	7.1	11.0	10.5	6.1	8.7					
TGX 1740 – 2F	8.1	11.7	11.7	8.8	10.1					
Mean	8.1	11.4	10.6	7.1						

	2002	2003	2004
LSD (0.05) for planting date (D) means	0.7	0.6	0.6
LSD (0.05) for variety (V) means	0.9	0.8	0.8
LSD (0.05) for D x V means	NS	1.6	1.6

Table 8: Effect of planting date on seed yield (kg/ha) of seven varieties of soybean in 2002 and 2003

Variety	Planting Date				Mean
	June	July	Aug.	Sept.	
			2002		
TGX 1485 - ID	828.7	1581.9	2937.9	464.6	1453.3
TGX 1440 - IE	365.8	479.8	336.5	156.2	334.6
TGX 1799 - 8F	494.3	526.6	652.9	196.1	467.5
NCR Soy - I	305.6	476.2	357.5	258.6	349.5
TGX 1831 – 32F	209.5	412.6	403.3	292.3	329.4
TGX 1878 - 7E	318.8	419.4	372.6	390.1	375.2
TGX 1740 – 2F	262.8	301.5	306.5	446.6	329.4
Mean	397.9	599.7	766.7	315.0	
			2003		
TGX 1485 – ID	255.5	344.6	979.6	224.0	450.9
TGX 1440 – IE	123.4	102.5	228.5	132.4	146.7
TGX 1799 – 8F	213.0	138.3	356.7	244.1	238.0
NCR Soy – I	70.7	184.3	212.0	49.1	129.0
TGX 1831 – 32F	201.4	149.2	440.3	228.7	254.9
TGX 1878 – 7E	131.3	81.1	352.3	108.8	168.4
TGX 1740 – 2F	179.8	148.2	386.1	210.7	231.2
Mean	167.9	164.0	422.2	171.1	

	2002	2003
LSD (0.05) for planting date (D) means	196.2	74.6
LSD (0.05) for variety (V) means	267.8	98.7
LSD (0.05) for D x V means	392.4	197.5

Table 9: Effect of planting date on seed yield (kg/ha) of seven varieties of soybean in 2004

Variety	Planting Date				Mean
	June	July	Aug.	Sept.	
			2004		
TGX 1485 - ID	757.3	3040.1	3079.5	1217.3	1987.7
TGX 1440 - IE	451.6	2451.6	1017.0	302.1	1021.1
TGX 1799 - 8F	610.6	3785.5	1880.6	1218.1	1830.9
NCR Soy - I	433.4	5656.9	1292.5	46.7	1816.5
TGX 1831 – 32F	465.0	3435.0	1347.0	1759.1	1708.3
TGX 1878 - 7E	378.0	3281.4	1142.3	391.2	1272.7
TGX 1740 – 2F	338.9	2446.2	1764.4	855.0	1331.5
Mean	490.6	3442.4	1645.2	827.1	
	Mean seed yield (2002, 2003 and 2004)				
TGX 1485 – ID	613.8	1655.5	3079.5	635.3	1496.0
TGX 1440 – IE	313.6	1011.3	1017.0	196.9	634.7
TGX 1799 – 8F	439.4	1409.1	1880.6	552.8	1070.5
NCR Soy – I	269.9	2105.8	1292.5	118.2	946.6
TGX 1831 – 32F	292.0	1332.3	1347.0	760.1	932.9
TGX 1878 – 7E	276.0	1260.7	1142.3	296.7	743.9
TGX 1740 – 2F	260.2	965.3	1764.4	504.1	873.5
Mean	352.1	1391.4	1646.2	437.7	
		2004	Mean yield		
LSD (0.05) for planting date (D) means		970.7	341.1		
LSD (0.05) for variety (V) means		NS	451.3		
LSD (0.05) for D x V means		NS	NS		

1799-8F and TGX 1831-32F in July planting date.

Soybean grain yields obtained in July and August were significantly higher than the yield values in June and September planting dates in 2002 (Table 8). In 2003, grain yield was higher in August than other planting dates. However, in 2004, grain yield was higher in July than other planting dates (Table 9). On consideration of the grain yield data as mean over the three years, July and August did not differ but gave significantly higher yield than June and September planting dates. On average, TGX 1485-1D produced significantly higher grain yield than other varieties, except TGX 1799-8F.

Interaction effects were significant in 2002 and 2003, with the TGX 1485-1D variety producing highest yield in August planting. Generally, grain yield was highest in 2004 and lowest in 2003, in which soybean was replanted in the same field plots used for the 2002 experiment

DISCUSSION

The results obtained in this study consistently showed that planting in July and August was optimum for seed weight and seed yield, probably due to the favourable photoperiod and rainfall regime at these periods. Averaged over three years, monthly rainfall appeared higher at over 300 mm with rainy days of 22 and 20 in July and August while sun shine hours and

temperature were lower in these months compared to June. Seed yield was increased by 331% and 247% by planting in July or August compared with June and September planting dates. While planting in the relatively longer days of June (Ezedinma, 1975) seemed unfavourable to soybean, planting in September resulted in poor yields due mainly to insufficient moisture during flowering and pod filling stages falling into drier months of the year. From the results, it took an average of 47.7 days to flower for September planting date. With planting done on 12 September as in 2003, the 50% flowering would occur about 29 to 30 October when moisture from October, especially November rains may not have been sufficient in quantity and duration to support effective podding and pod filling. Moisture stress at flowering, pod development and grain filling stage reduce soybean yield (Shaw and Lang, 1966, Caldwell et al., 1973).

The results further showed that time of sowing for optimum yield vary from location to location within a given agroecological zone. For example, Umudike, Uyo and Calabar are within the southeastern agroecology but optimum planting date for soybean in these areas vary. The present study showed optimum planting date for soybean in Umudike as July and August. However, Ndon et al. (1997) working in Uyo, recommended August as optimum sowing date for soybean while Oko *et al.* (1991) working in Calabar reported early to mid-September as optimum time of sowing for the crop. Disparities in response to planting date in different areas have been ascribed to variation in weather condition (Bello *et al.*, 1996).

Soybean TGX 1485-1D flowered earlier and consistently out yielded other varieties on average, except TGX 1799-8F, indicating good adaptation of these early maturing types to the lowland forest zone of south eastern Nigeria. Okpara and Ibiam (2000) had also reported superior yields with TGX 1485-1D compared to other varieties. The higher seed yield obtained with TGX 1485-1D variety was due primarily to greater seed weight and number of pods per plant. Higher number of pods and larger seed size has also been associated with higher yield in cowpea (Afolabi, 1980). The high seed yield of over 5000kg/ha obtained with the medium maturing NCRI Soy-1 in July in the 2004 experiment, suggests that performance of the varieties would depend not only on such factors as weather but also on edaphic factor. The soil used for the 2004 crop was higher in soil fertility and generally gave higher seed yield. Grain yield was poor and lowest in 2003 due mainly to the higher incidence of pests and diseases arising from replanting the same field plots used for 2002 crop.

CONCLUSION

The results of this study have clearly demonstrated that the best yield of soybean could be obtained by planting in July or August under the agroecosystem of Umudike. Two early maturing varieties TGX 1485-1D and TGX 1799-8F gave high yields compared to other varieties.

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