DOI: http://dx.doi.org/10.4314/gjass.v13i1.1

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 13, 2014: 1-6
 ISSN 1596-2903
www.globaljournalseries.com, Email: info@globaljournalseries.com

SEASONAL VARIATIONS IN THE GROWTH DURATION OF SOME RICE VARIETIES GROWN IN CROSS RIVER STATE

W. UBI, M. W. UBI, OTU IBOR AND A. U. AKPANIDIOK

(Received 28 April 2014; Revision Accepted 19 May 2014)

ABSTRACT

Two experiments were carried out in 2008 and 2009, in four locations in Cross State, to determine seasonal variations in the commonly grown rice varieties. Their response to different photoperiod treatments were investigated with rice plants in polyethylene bags subjected to varying lengths under artificial light. High photoperiod - sensitive varieties, showed significant difference in their maturation periods when planted at different times of the year. The longer growth duration occurred when plantings were made in January - February. The shortest growth duration occurred when plantings were made in the October - November period. In some of the photoperiod - sensitive varieties, there were big differences in the growth duration when planted in the same month, of different years. These varieties would be unsuitable for planting during the off season (August to September). The results are discussed in light of photoperiod sensitivity of some rice varieties planted at different times of the year.

KEYWORDS: Seasonal variation, growth duration of rice.

INTRODUCTION

In the Southern part of Nigeria where there are few or no irrigation facilities, rice is grown once a year. The growth duration and photoperiod sensitivity of the rice varieties cultivated may therefore appear relatively unimportant. Dore (2000) found that some of the Nigerian rice varieties are photoperiod sensitive (season fixed). The differences on maturation periods when planted at different dates are governed by the prevailing day length. Van (2001) suggested that work on the selection of photoperiod - sensitive varieties of rice was very important in determining the growth duration of rice varieties in relation to the prevailing day length.

Work on this aspect of crop improvement is scanty, especially study in the area that is related to the commonly grown rice varieties in Cross river State, Nigeria. Thus, a knowledge of the growth duration of both photoperiod - sensitive and insensitive varieties of rice under field and controlled condition is necessary. An explanation for the growth duration pattern when planted in different months is desirable. This study was carried out with the objective of estimating the growth duration of some Nigerian rice varieties as to determine the best season for greater crop yield.

MATERIALS AND METHODS

Location of Experiment:

The experiments were carried out simultaneously at four localities in cross river state, namely: Adim, Idomi, Assiga and Ofodua. The four locations are within longitude 8° 03° to 8° 17E° and Latitude 38° to 5°, 59° N. The main rainfall in most of the experimental area is 2500mm with a range of (2250 to 1700mm). Mean daily minimum and maximum temperatures vary from 21°c to 24°c and 27° to 32° respectively. Relative humidity varies from 82 to 97% (Eshiet, 1994).

The source for the planting materials was International Institute for Tropical Agriculture (IITA), Ibadan. The rice varieties were: Faro 12, Farao 15, Faro 44 and Faro 52.

The experiments were laid out in a randomized complete Black Design (RCBD), replicated three times with intra and inter – row spacing of 15x15cm. Plot size of 25 x20m, was maintained with sampling area of 2^2m.

For the natural day length, three seedlings were transplanted into the polyethylene bags containing about 5kg of soil later thinned to two plants and fertilized with lg of N, PO_2 and K_2O because the initial soil analysis results showed low values of the soil nutrients. The soils were flooded throughout the growth of plants.

The experiment for photoperiod was carried out at the World Bank Rice project Adim in June, 2008. Three 7 - day old seedlings were transplanted to each polyethylene bag containing 5kg of soil and fertilized with 2 each of N1 P_205 and K_20. The plants were subjected to 8, 10, 12, 13, 14 16 and 24 hours photoperiods, in a 24 hours cycle. The experiment was terminated after 200 days. Field data was subjected to analysis of variance (ANOVA) and means were compared using fishers least significant different at 5% probability level, using the methods of Obi (2000).

W. Ubi, Department of Science and Technology, National Open University, Calabar Study Centre Parliamentary, Calabar, Cross River State, Nigeria.
M. W. Ubi, Department of Soil Science, University of Calabar, Calabar, Cross River State, Nigeria.
Otu Ibor, Department of Forestry, University of Calabar, Calabar, Cross River State, Nigeria.
A. U. Akpanidiok, Department of Soil Science, University of Calabar, Calabar, Cross River State, Nigeria.

RESULTS

Experiment 1:

The average number of days from sowing to flowering of different varieties planted at various locations and months of the year are summarized in Table 1. The mean values of photoperiod sensitivity of **Faro 44** at the three locations (Adim, Idomi and Assiga) were significantly ($p<0.05$) higher in January 2009 than January 2008. Conversely, the mean values of **Faro** 52 and **Faro** 15 were significantly higher in 2008 than in 2009 planting season, under similar experimental conditions. The differences in maturity period (156 days) between January 2008 and January 2009 was highest in Adim location in plots where **Faro 44** was planted and lowest (29 days) in plots where **Faro 52** variety was planted (Table 1), the variations may be attributed to change in whether pattern.

Table 1: Growth duration (days from sowing to flowering) and differences between years of photoperiod sensitive varieties planted in January 2008 and 2009 at several locations.

variety	locations	years Jan.2008	Year Jan. 2009	LSD (0.05)	Difference in maturation period
Faro 44	Adim	136	292	148.9	97
	Idomi	146	243	91.6	37
	Assiga	134	97	35.7	-
	Total	4.6	544	-	
	Mean	138.6	181.3		
	LSD (0.05)	8.4	44.6		
Faro 12	Adim	270	224	44.3	46
	Idomi	171	138	31.9	33
	Ofodua	276	176	84.6	100
	Total	717	3.4	-	-
	Mean	239	157	-	-
	LSD (0.05)	5.6	37.1		
Faro 52	Adim	213	184	27.8	29
Faro 15	Ofodua	305	268	35.1	37
	Total	518	452	-	
	Mean	259	226	-	-
	LSD (0.05)	87.2	79.5	-	-

Table 2 shows photoperiod of four rice varieties from sowing to flowering with day length indicated in hours. At day length of 8 hours Faro 12 and 15 had flowering days of 67 and 66 respectively. The Faro 44 and Faro 52 had 72 and 106 days respectively. Increasing the number of hours from 8 to 10 did not show any significant different in terms of number of hours. When the numbers of hours were increased from 12 to 16 hours, there was a consistent increase in number of days from sowing to flowering. When it was further increased from 16 to 24 hours there were 7.0% drop in days in Faro 44, 5.9% in Faro 12 and 2.0% in Faro 52 during the study period.

Table 2: Photoperiod of four Nigerian rice varieties

variety	days	from	sowing	to	flowering	with	day	length	indicated in	hours
	8	10	12	13	14	16	24	LSD (0.05)	BVP	PSP
				hours						
Faro 44	72	64	80	112	119	121	113	7.1	29	57
Faro 12	67	67	89	86	123	144	136	15.6	32	77
Faro 52	106	88	116	146	153	171	168	9.0	53	83
Faro 15	66	65	80	*	*	*	*	12.3	30	100P
Mean	77.8	71.0	91.3	114.6	131.7	145.3	139.0	-	-	-
LSD (0.05)		5.0	18.3	8.6	32.1	28.5	25.6	-	30.7	-

* No flowering after 200 days

BVP = Basic vegetative phase (earlier flowering minus 35 days)

PSP = Photoperiod - sensitive phase (difference in days between earliest to latest flowering)

Table 3 shows growth duration (days from sowing to flowering of one rice variety planted at four locations (Faro 44). The values of growth duration for Faro 44 for 2008 and 2009 vary from one location to another, from January to December. The following days ranged as follows: 71-91 for Adim and Ofodua; 71-94 for Idomi; 80-91 for Assiga.

Table 3: Growth duration (days from sowing to flowering of one rice variety planted at different dates and localities.
Variety: Faro 44

		LOCATIONS				
month	**Years**	**Adim**	**Idomi**	**Assiga**	**Ofodua**	**LSD (0.05)**
January	2008	91	94	81	89	3.0
	2009	86	94	83	88	3.3
February	2008	87	93	85	85	4.0
	2009	89	93	86	91	3.0
March	2008	83	91	87	88	5.0
	2009	91	88	84	88	4.1
April	2008	86	94	91	90	3.0
	2009	89	84	89	90	5.0
May	2008	86	91	89	94	3.3
	2009	89	71	88	90	3.0
June	2008	87	87	89	93	3.0
	2009	86	85	82	84	3.2
July	2008	92	94	88	89	7.5
	2009	86	87	84	90	4.5
August	2008	81	96	`86	93	3.1
	2009	81	86	84	71	6.0
September	2008	81	82	86	86	3.0
	2009	80	78	84	84	4.2
October	2008	80	75	84	84	6.1
	2009	75	78	85	82	5.0
November	2008	79	89	84	94	5.4
	2009	71	78	86	80	4.8
December	2008	88	83	84	83	3.6
	2009	80	83	80	80	3.0
Longest		91	94	91	94	
Shortest		71	71	80	71	
Differences		20	23	11	23	

Differences between locations in terms of days from sowing to flowering of Faro 44 variety were statistically significant ($p<0.5$). However, values for Assiga and Ofodua for February, March, April, July, September. October and December tended to be similar in 2008 (Table 3). There were no variations in values of certain months in 2009 from April to June then September and December.

Table 4 shows values of Faro 12 on growth duration for four locations in which values ranged as follows:- 79-114 for Admin, 76-94 for Idomi, 79 – 117 for Assiga and 74 – 118 days for Ofodua during the 2008 and 2009 planting seasons. Differences between locations in terms of growth duration were significant ($p<0.05$), from January to December in 2008 and 2009 planting seasons. The mean values were higher from February to July for Adim and Ofodua. The average mean values tended to decrease in the four locations from August to December and the decrease followed a similar pattern.

Table 4: Growth duration days from sowing to flowering of faro 12 rice variety planted at different dates and localities.

Variety: Faro 12

month	Years	LOCATIONS				
		Adim	**Idomi**	**Assiga**	**Ofodua**	**LSD (0.05)**
January	2008	90	79	104	90	9.2
	2009	83	82	102	92	8.3
February	2008	99	82	90	101	9.0
	2009	106	87	80	114	7.0
March	2008	104	82	94	112	11.1
	2009	117	86	92	115	5.8
April	2008	111	90	102	108	5.7
	2009	113	87	101	118	5.0
May	2008	112	91	99	115	7.2
	2009	114	92	117	114	16.4
June	2008	109	90	82	106	6.8
	2009	103	90	103	103	12.1
July	2008	111	94	93	103	9.6
	2009	103	88	104	97	6.0
August	2008	93	87	97	94	9.0
	2009	90	85	91	85	4.8
September	2008	82	83	79	77	3.0
	2009	80	85	90	74	4.7
October	2008	81	76	97	77	4.0
	2009	85	81	94	80	4.0
November	2008	80	83	89	90	5.4
	2009	79	86	90	78	5.3
December	2008	88	83	93	84	4.0
	2009	79	83	89	90	4.0
Longest		117	94	117	115	
Shortest		79	76	79	77	
Differences		38	18	38	38	

The results of growth duration of variety Faro 52 planted at four locations is presented in Table 5, in which the highest growth duration 199 days was recorded in May 2008 at Assiga while the lowest, 105 in September was recorded in Idomi location. The implication here is that Faro 52 variety had delayed flowering in the four locations than either Faro 12, or Faro 44.

Table 5: Growth duration (days from sowing to flowering of one rice variety planted at different dates and localities (Faro 52)

Variety: Faro 52

month	Years	LOCATIONS				
		Adim	**Idomi**	**Assiga**	**Ofodua**	**LSD (0.05)**
January	2008	121	126	112	125	5.0
	2009	131	130	118	118	10.2
February	2008	119	130	117	125	5.0
	2009	130	131	119	136	12.6
March	2008	123	125	118	118	6.4
	2009	128	132	117	141	8.8
April	2008	124	122	199	128	7.9
	2009	147	127	118	121	7.6
May	2008	124	122	199	128	4.0
	2009	147	127	118	121	18.5
June	2008	120	116	116	127	6.2
	2009	128	125	118	123	4.0
July	2008	126	128	115	127	9.8
	2009	125	120	117	128	7.3
August	2008	114	114	112	122	7.7
	2009	118	112	112	125	5.1
September	2008	117	111	113	119	4.0
	2009	119	105	110	119	5.0
October	2008	117	115	113	123	4.5

	2009	115	108	111	121	6.1
November	2008	112	116	109	118	4.0
	2009	112	115	109	113	4.0
December	2008	112	122	112	115	6.3
	2009	121	121	112	115	6.2
Longest		147	132	119	141	
Shortest		112	105	109	113	
Differences		35	27	10	38	

However, differences in mean values between the four locations were significant ($p<0.05$) throughout the experimental seasons.

Table 6 shows the growth duration values of Faro 15, in four study locations in which the highest (250 days) occurred in February 2009 at Adim while the lowest (106 days) occurred in October 2009 at Idomi. Days from sowing to flowering of this variety showed greater values in 2008 planting, on the average than 2009 planting. Equally, these values showed that Faro 15 variety delayed flowering at different planting dates and locations more than Faro 12 and Faro 44 varieties throughout the study season.

Table 6: Growth duration (days from sowing to flowering of four rice varieties planted at different dates and localities. (Faro 15)

Variety: Faro 15

month	Years	LOCATIONS				
		Adim	**Idomi**	**Assiga**	**Ofodua**	**LSD (0.05)**
January	2008	210	249	148	213	34.2
	2009	211	244	136	184	32.6
February	2008	249	249	186	232	49.8
	2009	250	236	163	249	12.5
March	2008	233	122	182	227	55.6
	2009	224	120	161	226	36.1
April	2008	212	199	165	205	32.6
	2009	212	192	163	194	9.2
May	2008	182	184	156	178	25.3
	2009	188	181	150	174	23.3
June	2008	162	123	147	163	16.9
	2009	158	124	140	151	6.0
July	2008	146	142	139	148	6.0
	2009	139	135	141	142	5.0
August	2008	119	123	120	131	4.0
	2009	121	120	119	125	4.0
September	2008	112	125	118	123	5.2
	2009	117	108	115	199	5.0
October	2008	117	120	116	125	4.0
	2009	110	106	108	119	4.0
November	2008	108	112	115	124	4.0
	2009	108	121	111	118	6.5
December	2008	124	132	124	129	5.1
	2009	132	124	116	130	7.2
Longest		200	224	186	249	
Shortest		108	106	109	118	
Differences		142	143	78	131	

Experiments 2

In the photoperiod experiment, the two varieties which showed high variation in growth duration in the field also showed high photoperiod sensitivity. The turning points for these varieties were less than 12 hours. The turning point is defined as the minimum photoperiod longer than 10 hours was found to definitely prolong the growth duration of faro 52 and Faro 15, in which for 198 days there was no flowering (Fig 1)

DISCUSSION

The existing Nigerian rice varieties can be divided essentially into two groups; those that are highly photoperiod sensitive and those that are weakly photoperiod - sensitive. The flowering of highly photoperiod sensitive varieties (classified as season - fixed) represented by Faro *52,* was greatly delayed by a small increase in length of the photoperiod. At certain photoperiods no flowering was obtained even after 200

days of growth, (Dore 2000). The weakly photoperiod - sensitive varieties (Period - Fixed) such as Faro 15 and Faro 52 showed very little variation in growth duration under field conditions, but were delayed in flowering when subjected to long photoperiods (12-16 hours). The delay however was not as great as the highly photoperiod - sensitive verities, (Table 3-6).

Although the results of the experiments tend to show that sensitivity to photoperiod is the factor determining the growth duration, it is not the only factor. Growth duration of any variety is determined by the length of the vegetative reproductive and ripening phases. Since the duration of reproductive and ripening phases are essentially constant, it is therefore the vegetative phase that differs and determines the growth duration of the variety (Vergara *et al,* 1995). Two varieties that were photoperiod -insensitive were Faro 44 and Faro 12. although the growth duration of Faro 12 is longer than Faro 44, both varieties showed very little variation in growth duration with different photoperiods, (Van, 2001) Jugoe, 2003; Later, 2005).

The test varieties Faro 52 and Faro 15, which were considered as “period fixed” and their curves, (Fig I); contrast strongly with those of Faro 44 and Faro 12. The relative short duration of Faro 44 was mainly the result of high temperature (Vergara *et al,* 1995: Dore, 2000). Varieties that do not flower or take longer than 200 days to flower at 13 hours, will be sensitive to day length changes in Cross River State, Nigeria.

An interesting observation made in the field experiments was the great difference in growth duration of the highly photoperiod sensitive varieties, planted in the same month not in different year. It is suggested in this study that cloudiness may have something to do with this big difference in photoperiod sensitivity of Faro 12 and Faro 44.

A small difference in day length may cause a great delay in the growth duration of a photoperiod - sensitive variety. It was found that cloudy weather in the early and late part of the day shortens the twilight hour, and hence, the effective day length.

A difference of 30-40 days in growth duration as a result of cloudiness has been reported (VETCH, 2000; Jagoe and Later, 2002).

CONCLUSION

The result of this study has shown that growth duration of any rice variety is determined by the length of the vegetative reproductive and ripening phases. Since the duration of reproductive and ripening phases is essentially constant, it is the vegetative phase that differs and determines the growth duration of the rice variety. In this test, the growth duration of Faro 44 and Faro 12 did not vary much with different photoperiods- These test varieties Faro 44 and Faro 12 did not vary much with different photoperiod. These test varieties (Faro 44 and Faro 12) contrast strongly with those of Faro 52 and Faro 15.

REFERENCES

Dore, J., 2000. The relation of flowering and maturation period in Malayan rice to sowing date. Agric J. 423:128-133.

Dore, J., 2001. The relation of flowering and maturation period in Malayan rice to sowing data. Agric J. 433:233-242.

Jagoe, R. B and Larter, L. N., 2002. Improvement of rice varieties in Tropical Soil. Agric J. 34:127-133.

Jagoe, R. B and Larter, L. N., 2003. Photoperiodism of *Oryza Sativa.* Agric. J. 105:635-645.

Larter, L. N., 2005. Rice variety trials in tropical Soil. Series No. 25.95-112.

Obi, I. U., 2000X. Statistical methods of detecting differences between treatment means (SNAAP), press Limited Enugu, Nigeria. 45pp.

Van, J. K., 2001. Rice variety, tropical soil, Bulletin 114, the Division of Agriculture and Co-operatives, Kuala Lumpur.

Vergara, B. S. S., Puranab Having and Lilis, R., 1995. Factors determining the growth duration of rice varieties. Phyton 22:179-189.

Vetch, J., 2000. Contrils. 137 Gen. Agric Res. Station, Begor, Indonesia cited by R. Best, IN Photoperidism in Rice. Field crop Abstracts. 12: 85-93.