at par with 120 kg ha^{-1} for the combined analysis. At Maigana in 2012 and combined, 40 kg ha^{-1} seed rate recorded more days to 50% heading than 120 kg ha^{-1} and was statistically similar with 80 kg ha^{-1} however, 80 kg ha^{-1} in turn was at par with 120 kg ha^{-1} at the combined analysis.

Days to 50% heading significantly responded to sowing methods only in the combined analysis at Samaru and in 2011 at Maigana. At both locations, result revealed that dibbled rice delayed heading which was statistically similar with drilled rice only at Samaru and the drilled rice in turn was at par with broadcast rice at both locations.

Table 2: Effect of seed rates and sowing methods on net assimilation rate and dry matter of three upland rice varieties at Samaru and Maigana in 2011 and 2012 wet seasons

	Samaru				Maigana				Samaru				Maigana		
Treatments	Net assimilation rate				Net assimilation rate				Dry Matter				Dry Matter		
	2011	2012	Combined		2011	2012	Combined		2011	2012	Combined		2011	2012	Combined
Seed Rates (R)															
40	0.02	0.04	0.02		0.07a	0.11	0.06		4.7	18.2	11.4		3.3	11.8	7.6
80	0.01	0.04	0.02		0.06b	0.10	0.05		4.7	19.3	12.0		3.2	11.0	7.1
120	0.01	0.04	0.02		005c	0.08	0.04		4.7	17.8	11.2		3.2	10.9	7.0
SE ±	0.32	0.002	0.001		0.002	0.016	0.008		0.01	1.14	0.57		0.08	0.71	0.35
Sowing Method (S)															
Broadcasting	0.02	0.04	0.02		0.07a	0.12	0.06		4.7	21.0a	12.8a		3.2	11.6	7.4
Drilling	0.01	0.04	0.02		0.05b	0.08	0.04		4.7	17.7ab	11.2ab		3.2	11.1	7.1
Dibbling	0.01	0.04	0.02		0.07a	0.09	0.05		4.7	16.6b	10.7b		3.3	11.0	7.1
SE ±	0.32	0.002	0.001		0.001	0.016	0.008		0.01	1.14	0.57		0.08	0.71	0.35
Variety (V)															
NERICA 4	0.01	0.03b	0.02b		0.06b	0.08	0.04		4.8a	25.0a	14.9a		3.3b	11.0ab	7.1b
NERICA 8	0.01	0.03b	0.02b		0.08a	0.08	0.05		4.3b	19.2b	11.7b		3.7a	12.7a	8.2a
JAMILA	0.01	0.06a	0.03a		0.05c	0.13	0.07		4.3b	11.2c	8.1c		2.8c	10.0b	6.4b
SE ±	0.22	0.002	0.001		0.001	0.017	0.008		0.01	1.08	0.54		0.09	0.62	0.32

Means followed by the same letter (s) within same column and treatment group are not statistically different at 5% level of probability using Duncan Multiple Range Test (DMRT). WAS= weeks after sowing.

There was significant variation among the varieties of the three upland rice varieties on days to 50% heading in the two years of study at both locations. In all the years at both locations, JAMILA significantly delayed in days to 50% heading, followed by NERICA 4 while NERICA 8 recorded the earliest of days to 50% heading.

Effect of seed rate and sowing method in 2011 and 2012 wet seasons and the combined on days to pphysiological maturity of three upland rice varieties at Samaru and Maigana are presented in Table 3.Seed rates significantly influenced days to physiological maturity only in 2012 and the combined in both locations.

At Samaru in 2012 and the combined, 40kgha^{-1} seed raterecorded more days to physiological maturity than 120kgha^{-1} which was statistically similar with 80kgha^{-1}.But 80kgha^{-1} seed rate in turn was at par with 120kgha^{-1} for the combined analysis. At Maigana where 40 kg ha^{-1} seed rate recorded more number of days to 50% physiological maturity, followed by 80 kg ha^{-1} while 120 kg ha^{-1} recorded the earliest days to maturity.

Sowing methods did not indicate significant effect on days to physiological maturity throughout the two years of study at both locations.

There was significant variation among the three varieties of the upland rice on days to physiological maturity in the two

years of study in both locations. In all the years in both locations, JAMILA significantly recorded the more number of days to physiological maturity, followed by NERICA 4 while NERICA 8 recorded the least number of days to physiological maturity and was statistically similar with NERICA 4 in 2012 at Maigana.

Table 3: Effect of seed rates and sowing methods on days to 50% heading and days to 50% physiological maturity of three upland rice varieties at Samaru and Maigana in 2011 and 2012 wet seasons

	Samaru			Maigana			Samaru			Maigana		
Treatments	Days to 50% heading			Days to 50% heading			Days to 50% Maturity			Days to 50% Maturity		
	2011	2012	Combined	2011	2012	Combined	2011	2012	Combined	2011	2012	Combined
Seed Rates (R)												
40	76.9	86.8a	81.9a	77.0	84.2a	80.6a	101.6	110.2a	105.9a	101.5	107.6a	104.6a
80	76.4	83.3b	79.8b	76.7	81.9a	79.3ab	100.9	108.9a	104.8ab	99.6	103.9b	101.7b
120	77.3	81.0c	79.2b	77.1	78.9b	78.0b	100.7	107.1b	104.0b	101.3	101.7c	101.5b
SE ±	0.51	0.53	0.31	0.26	0.78	0.45	0.58	0.51	0.40	0.76	0.59	0.51
Sowing Method (S)												
Broadcasting	76.3	82.9	79.6b	76.2b	81.7	78.9	100.2	108.4	104.3	100.2	104.6	102.4
Drilling	76.6	83.7	80.2ab	76.6b	81.5	79.1	101.3	108.4	104.8	100.3	103.8	102.0
Dibbling	77.7	84.4	81.1a	78.0a	81.7	79.9	101. 6	109.4	105.5	101.9	104.8	103.4
SE ±	0.51	0.53	0.31	0.26	0.78	0.45	0.58	0.45	0.57	0.76	0.59	0.51
Variety (V)												
NERICA 4	71.3b	79.4b	75.4b	70.9b	76.0b	73.4b	96.2b	102.6b	99.4b	96.6b	97.4b	97.0b
NERICA 8	69.2c	75.7c	72.5c	68.7c	73.7c	71.2c	88.4c	100.4c	94.4c	86.6c	96.7b	91.7c
JAMILA	90.1a	95.8a	93.0a	91.2a	95.4a	93.3a	118.5a	123.2a	120.9a	119.3a	119.0a	119.2
SE ±	0.56	0.64	0.42	0.26	0.53	0.31	0.54	0..45	0.36	0.64	0.57	0.43

Means followed by the same letter (s) within same column and treatment group are not statistically different at 5% level of probability using Duncan Multiple Range Test (DMRT). WAS= weeks after sowing.

4. Discussion

The higher CGR obtained was due absorbed sun radiation with increase in leaf area which also increased dry matter accumulation . The CGR after reaching the maximum rate, decreased. This was in case of leaves that grow old and shedding as a result of dry matter decreases due to leaves shedding. [4] got similar results.The ability of leaves in sun absorption and high material transportation in NERICA varieties was responsible for the differences observed in NAR. Also RGR deceases in growth season length with increase of plant age in rate of structure texture to metabolic tissue which decreased and shadow of upward leaves to lower leaves restricted appropriate usage from sources. [17]reported that LAI and total dry matter were related to each other and the high LAI in the flowering stage is necessary for high yielding.

The earlier heading and maturity recorded at higher seed rates at Samaru and Maigana in 2012 and the combined was however expected since increasing numbers of seed rates would result in high competition for scarce resources thereby resulting in stress. The stress imposed in turn led to early heading and maturity. At low plant population and especially with adequate growth resources, vegetative growth would be prolonged thereby leading to delay in maturity. The reverse was the case at high seed rate due to intense competition for scarce resources which might be exhausted within a short period that consequently led to early heading and maturity.

The non-significant differences in sowing methods on the net assimilation rate, relative growth rate and shoot dry weight in the two years of this study was because the three sowing methods promoted rapid and vigorous growth of the crops which enable them to utilize the available resources. On the other hand, the higher shoot dry weight recorded by broadcasting than other methods was due to uneven distribution of seeds on the plots which may have enable crops sown by broadcasting methods to trap more sunlight for photosynthesis which led accumulation of more dry matter.

The early heading reached by crops sown using broadcasting methods was because of shallow root establishment with higher intra competition due uneven spacing between the plants per unit area which triggered quicker reproductive phase responses. Dibbling and drilling methods significantly delayed days to 50% heading which definitely prolonged maturity period.Similar observation was made by [18] who reported that growth dyanmics and partitioning patterns of rice depend on cultural practices particularly sowing methods. Though all the varieties used were early maturing varieties, the maturity periods greatly depends on the genotype and

cultural practices. Therefore, the varietal growth and development responses to different sowing methods should be considered when selecting the most appropriate sowing methods.

The variation in growth and development among the three rice varieties could be attributed to the genetic characteristics and environmental factors such as temperature, photoperiods and light intensity, soil factors and cultural manipulation such as plant density, planting methods and moisture supply [19]. The similarity in the genetic make-up of the varieties displayed at both locations was an indication that less robust varieties were able to make equal utilization of the environmental resources as other varieties hence lack of variation in RGR and NAR. This is in agreement with [12] who reported that varieties exhibit high similarity in terms of response to input levels and the overall effect expressed depend mainly on interaction with the environment. The significant variation among the varieties in terms of time taken to reach fifty percent heading and physiological maturity was mainly genetic and other resources such climatic and nutrition which prolonged the vegetative period. Under optimum growing conditions the number of days to 50% heading of rice crop can alternatively be used to estimate the number of days to attain maturity. The early heading and maturity of NERICA 4 and 8 in the two seasons at both locations is an indication that the two varieties are early maturing. This character was confirmed by [20] who described NERICA varieties as early maturing. The significant variation in days to maturity of two NERICA varieties and JAMILIA indicated that the varieties used in these experiments did not belong to the same maturity group. Maturity of rice varieties can be classified as very early (less than 105 days), early (105-120), medium (121-135days, late (136-160days) and very late (over 160 days) [21]. Unlike ripening phase, which takes 35days after 50% heading to reach maturity, the vegetative phase, irrespective of the variety is the only growing phase that varies to give differences in maturity periods among rice genotypes [21]. Hence, the varieties tested except JAMILA were classified as very early maturing. The delay in Maturity of JAMILIA variety could be due to their robust vegetative growth resulting from the efficient utilization of resource which caused increase in the assimilatory leaf area thereby increasing dry matter production and allocation to vegetative parts hence delaying maturity period. Shah [22] reported that some varieties were more efficient in transfer of photosynthate to economic sink.

5. Conclusion

Based on the result obtained from the study, it can be inferred that JAMILA matured later and had higher physiological indices in Samaru while NERICA 8 perform better in Maigana. Consequently broadcasted or drilled rice performed better at 40 kg ha^{-1} seed rate**.**

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