The Andhra Agric. J 58(2):192-197, 2011

Dry Matter Production and Grain Yield in Rice Under SRI Cultivation

G Rama Rao and K Balakrishana Reddy
Department of Plant Physiology, S.V.Agricultural College, Tirupathi 517 502, A P

ABSTRACT

Two field experiments were conducted during *kharif* seasons of 2007 and 2008 at Wetland farm of S.V.Agricultural college Tirupathi to study the dry matter production and grain yield in rice under SRI cultivation .The results revealed that significant differences were observed among the cultivars and age of seedlings with regard to leaf ,stem ,root ,grain and , of total dry matter production at all stages of plant growth .Maximum leaf ,stem ,root ,grain and total dry matter and grain yield was produced by SRI-8 days followed by SRI-12 days and least was recorded in conventional method of 21 days .Among the cultivars tested ,BPT 5204 recorded higher dry matter production (133 g/plant) and grain yield (7.75 t/ha) followed by DRRH 2 (119.2 g/plant and 7.3 t/ha) ,NLR145(107 g/plant and 6.96 t/ha) and BPT 3291(96.2 g/plant and 6.72 t/ha).The interaction between cultivars and age of seedlings was significant .

Key words : Grain yield, Harvest index, System of rice intensification (SRI), Total dry matter production.

The system of rice intensification methodology (SRI) was first synthesized in early 1980 by Lavlane Henri De in Madagascar .It is a methodology for increasing the productivity of irrigated rice by changing the management of plants ,soil ,water and nutrients .The positive results from SRI methods have been reported from Madagascar , China ,Philippines , and Srilanka and yield increase of 50-100% are common with some times even a tripling of yield under SRI (Zbu Defeng et al 2002, Tao Long Xing et al 2002 and Thiyagarajan ,2002) .Southern zone of A P was shown to be highly suitable for this technology .Much of the research work was done outside India, but a systematic basic physiological research in this native environment has not been taken up. Hence, a detailed study was taken up to know the dry matter production and grain yield of rice under SRI cultivation compared to conventional method.

MATERIAL AND METHODS

Two field experiments were conducted at wetland farm, S.V. Agriculture College Tirupathi during kharif 2007 and 2008 in factorial randomized block design with 12 treatments and three replications. The treatments composed of 4 cuttuvars (BPT 5204, BPT 3291, NLR 145, and DRRH-2) and 3 types age of seedlings (SRI-8 days, SRI-12 days, conventional method -21 days). The spacing adopted in SRI cultivation was 25 X 25 cm and conventional method was 20x10 cm. The plots size was 5 x 4 mts .The seedlings were raised separately on raised seed beds.

Under SRI method, 8 and 12 days old rice seedlings with two leaves were transplanted, one seedling per hill. From transplanting to 7 days after transplanting, a water layer of 1 to 3 cm deep was maintained on the paddy field. From 7 DAT to maturity there was no water layer on the field and soil water was maintain in moist condition by quick irrigation as desired. Under conventional method, 21 days old rice seedling with five leaves was transplanted with two to 3 seedlings per hill. A water layer of 1-5 cm deep was maintained on the rice field during the entire growth period in conventional method. Normal fertilizer dose was applied on both the methods .Inter cultivation with cono- weeder was done once in 10 days up to panicle initiation stage in both sides in SRI method. Sampling was done 30 days time interval. The data on leaf, stem, root, grain, total dry matter, and yield and yield components were recorded. The statistical analysis was done following Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The data on root dry matter are given in table 1.Significant differences were observed among cultivars and different age of seedlings in root dry matter at all stages of plant growth .In all the cultivars, the root dry matter increased continuously with age of the crop up to 120DAT and later declined .Maximum root dry matter was produced by SRI-8 days (22.7 g/plant) followed by SRI-12 days (20.9 g/plant) and least in conventional method -21 days (10.5g/plant). At 30 DAT ,DRRH2 recorded

maximum root dry matter (1.81g/plant),followed by BPT 5204 (1.33 g/plant) ,NLR145(1.17 g/plant) and BPT3291(1.11g/plant).Later at all stages of samplings ,BPT 5204 recorded maximum root dry matter followed by DRRH2 ,NLR145 and BPT3291. The higher root dry matter in SRI-8 days might be due to root oxygenation ability. (Robert Phillipson, 2002). The interaction between cultivars and age of seedlings was significant.

The data on stem dry matter production are given in table 1. Significant differences were observed among cultivars and age of seedlings with regard to stem dry matter at all stages of plant growth. In all the cultivars, stem dry matter increased continuously with age of the crop up to 120DAT and later declined .Maximum stem dry matter was produced by SRI-8 days (30.78 g/plant) followed by SRI-12 days (28 g/ plant) and least in conventional method-21days (14.18 g/plant) .The higher stem dry matter in SRI-8 days might be due to higher tiller number and LAI. Similar results were reported by Wang Shao-Bua et al (2002) in rice. Among the cultivars, BPT5204 recorded higher stem dry matter at 120 DAT (28.1 g/plant) followed by DRRH2 (26g/plant), NLR145 (23.49 g/plant) and BPT3291 (19.8g/plant).The interaction between cultivars and age of seedlings was significant.

The data on leaf dry matter are given in table 2. Significant differences were observed among cultivars and different age of seedlings in leaf dry matter at all stages of plant growth in all the cultivars The leaf dry matter increased continuously with age of the crop up to 120DAT and later declined .This is due to the senescence of older leaves. The fall in dry matter during subsequent stage of growth may be due to senescence and translocation of photosynthates to the developing grains. In rice all the leaves from the flag leaf down to third leaf from the top export assimilates to the panicles (Tanaka,1958).Maximum leaf dry matter was produced by SRI-8 days (26. g/plant) followed by SRI-12 days (24.1 g /plant) and least was recorded in conventional method-21 days(11.81g/plant).The higher leaf dry matter in SRI-8 days might be due to effective leaf area , more chlorophyll content and high photosynthetic rate (Wang Shao-Bua *et al* 2002) .Among the cultivars , BPT5204 recorded maximum leaf dry matter at 120 DAT (23.97 g/plant) followed by DRRH-2(21.56g/plant) ,NLR145(19.76 g/plant) and BPT3291(17.97g/plant) .The interaction between cultivars and age of seedlings was significant .

The data on grain dry matter are given in table 2. Significant differences were observed among cultivars and age of seedlings in grain dry matter at all stages of plant growth. In all the cultivars, the grain dry matter increased from 120 DAT to till maturity. Maximum grain dry matter was produced by SRI-8 days (72.4g/plant) followed by SRI-12 days (64.1g/plant) and least was in conventional method -21days(31g/plant). The higher grain dry matter in SRI -8 days might be due to higher tiller number, higher SCMR and higher translocation of assimilates .Similar results were reported by Thayagarajan (2002) in rice. Among the cultivars, BPT5204 recorded maximum grain dry matter at maturity (65.9g/plant) followed by DRRH-2(58.3g/plant), NLR145 (51.8g/ plant) and BPT3291 (47.3g/plant) .The interaction between cultivars and age of seedlings was significant.

The values of total dry matter were presented in table 2. There was a gradual increase in total dry matter from 30DAT to maturity in all the cultivars. Significant differences were observed among cultivars and different age of seedlings with regard to total dry matter at all stages of plant growth .In all the cultivars , maximum total dry matter was recorded at maturity. Maximum total dry matter was produced by SRI-8 days (146.7g/plant)followed by SRI-12 days(131.7g/plant) and least was in conventional method-21 days(63.8 g/plant) .The higher total dry matter in SRI-8 days might be due to higher tiller production ,LAI and root volume .Similar results were reported by Tao long Xing et al (2002)in rice . Among the cultivars ,BPT 5204 recorded maximum total dry matter at maturity (133.3 g/plant)followed by DRRH-2 (119.1 g/plant) ,NLR145(107g/plant) and BPT3291(96.2g/plant).It is desirable to have higher dry matter content in leaves at the time of grain filling stage to obtain maximum yield. Among the cultivars, BPT 5204 maintained high leaf dry matter at grain filling stage and hence it produced maximum grain yield. The interaction between cultivars and age of seedlings was significant

The data on yield and yield components of rice cultivars are given in table 3. The maximum yield was obtained with SRI-8 days (8.2 t/ ha) followed by SRI-12 days (7.65 t/ha) and conventional method-21 days (5.67 t/ha). Among the varieties, BPT 5204 recorded maximum yield (7.75 t/ha) followed by DRRH-2 (7.3 t/ha), NLR -145 (6.93 t/ha) and BPT-3291 (6.72 t/ha). The higher yield in SRI-8days might be due to higher tiller production, no of grains per panicle, test weight, CGR and SCMR. Similar results were reported by Wang Sbao – bua *et al* (2002) in rice.

Table 1. Root and stem dry matter accumulation (g/plant) in rice cultivars under SRI cultivation and conventional method

Cultivars		30DAT				90DAT				120 DAT				Manturity			
		SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean
		8	12	21		8	12	21		8	12	21		8	12	21	
BPT 5204	Root	1.80	1.50	0.70	1.33	23.4	20.8	10.2	18.13	25.6	23.4	11.5	20.17	22.3	20.1	10.1	17.50
	Stem	1.35	1.20	0.62	1.06	25.4	23.2	11.5	20.04	35.4	32.5	16.3	28.07	34.1	31.6	15.1	26.93
BPT3291	Root	1.40	1.30	0.60	1.11	17.3	15.6	7.8	13.57	19.6	18.2	9.5	15.77	16.7	15.1	7.5	13.10
	Stem	1.11	1.09	0.50	0.90	18.6	16.8	8.5	14.63	25.6	22.4	11.3	19.77	24.3	21.3	10.3	18.63
NLR 145	Root	1.50	1.35	0.65	1.17	19.6	17.5	8.5	15.20	21.8	20.3	10.1	17.40	18.5	17.2	8.5	14.73
	Stem	1.20	1.10	0.53	0.94	20.4	18.3	9.2	15.97	29.5	27.1	13.5	23.37	28.3	26.0	12.1	22.13
DRRH 2	Root	2.50	2.00	0.92	1.81	21.2	19.3	9.6	16.70	23.8	21.7	10.7	18.67	20.1	18.3	9.0	15.80
	Stem	1.60	1.40	0.71	1.24	22.5	20.5	10.4	17.80	32.4	30.0	15.6	26.00	31.1	29.1	14.3	24.83
Mean	Root	1.80	1.54	0.72	-	20.4	18.3	9.0	-	22.65	20.9	10.4	-	19.4	17.6	8.8	-
	Stem	1.31	1.19	0.59	-	21.7	19.7	9.9	-	30.73	28.0	14.1	-	29.45	27.0	12.95	-
CD at 5%																	
V	Root				0.45				0.50				1.25				1.60
	Stem				0.15				2.10				1.80				1.85
A	Root				0.25				1.75				1.70				1.52
	Stem				0.10				1.80				1.80				2.10
V x A	Root				0.50				0.60				0.75				0.80
	Stem				0.05				1.20				1.30				1.20

V: Varieties A: Age of seedlings Conven: Conventional method

Table 2. Leaf and grain and total dry matter (g/plant) accumulation in rice cultivars under SRI cultivation and conventional method.

Cultivars		30DAT				90DAT				120DAT				Maturity			
		SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean
		8	12	21		8	12	21		8	12	21		8	12	21	
BPT 5204	Leaf	1.34	1.24	0.60	1.06	16.32	14.10	7.30	12.57	30.40	28.1	13.4	23.97	29.0	27.3	12.5	22.9
	Grain	-	-	-	-	-	-	-	-	65.6	52.0	30.0	49.20	85.3	76.8	35.8	65.9
	Total	4.49	3.90	1.92	3.44	65.12	56.1	29.0	50.75	157.0	136.0	71.2	121.4	170.7	155.8	73.5	133.3
BPT3291	Leaf	0.95	0.84	0.45	0.75	11.10	9.70	4.30	8.36	23.3	20.5	10.0	17.97	22.3	19.5	9.5	17.1
	Grain	-	-	-	-	-	-	-	-	50.8	40.3	18.5	36.57	60.8	55.6	25.6	47.3
	Total	3.46	3.23	1.55	2.75	47.00	42.10	20.6	36.57	119.3	101.4	49.4	90.0	124.1	111.5	52.9	96.1
NLR 145	Leaf	1.16	1.05	0.52	0.91	12.50	10.39	5.10	9.33	25.1	22.7	11.5	19.76	24.2	21.5	11.0	18.9
	Grain	-	-	-	-	-	-	-	-	54.6	48.3	21.5	41.47	65.0	60.3	30.3	51.8
	Total	3.86	3.50	1.70	3.02	52.60	46.15	22.8	40.37	131.2	118.4	56.6	102.0	136.0	125.0	61.9	107.6
DRRH 2	Leaf	1.51	1.33	0.75	1.20	14.50	12.80	6.2	10.96	27.3	25.1	12.3	21.56	26.3	24.3	11.5	20.7
	Grain	-	-	-	-	-	-	-	-	60.3	55.0	25.3	46.87	78.5	64.0	32.5	58.3
	Total	5.61	4.73	2.38	4.24	58.20	52.50	26.2	45.67	143.6	131.8	63.9	113.1	156.0	134.5	66.9	119.1
Mean	Leaf	1.24	1.12	0.58	-	13.60	11.60	5.7	-	26.5	24.1	11.8	-	25.4	23.4	11.1	-
	Grain	-	-	-	-	-	-	-	-	57.8	48.9	23.8	-	72.4	64.1	31.0	-
	Total	4.36	2.66	1.89	-	55.73	49.74	24.6	-	137.7	121.9	60.2	-	146.7	131.	63.8	-
CD at 5%																	
V	Leaf				0.18				1.10				0.9				1.5
	Grain				-				-				4.1				4.5
	Total				0.73				4.30				7.1				10.3
A	Leaf				0.10				1.80				2.1				1.0
	Grain				-				-				7.5				7.1
	Total				0.75				4.80				13.5				12.5
V x A	Leaf				0.08				0.80				0.8				0.9
	Grain				-				-				2.5				3.4
	Total				0.50				3.10				6.5				7.5

V: Varieties A: Age of seedlings Conven: Conventional method

Table 3. Yield and yield components of rice cultivars under SRI and conventional method

Cultivars	Grain yield (t/ha)				No.of panicles/plant				No.of grains/Panicle				1000 grain wt (g)				Harvest index			
	SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean	SRI		Conv.	Mean
	8	12	21		8	12	21		8	12	21		8	12	21		8	12	21	
BPT 5204	8.80	7.97	6.50	7.75	58.0	47.0	25.3	43.43	195	184	180	186.3	14.85	14.40	14.10	14.45	0.51	0.48	0.47	0.47
BPT 3291	7.71	7.45	5.00	6.72	45.0	38.0	16.5	33.16	173	168	160	167.0	19.40	19.10	18.90	19.13	0.46	0.45	0.39	0.43
NLR 145	7.80	7.50	5.50	6.93	47.0	41.4	18.3	35.56	181	173	165	173.0	20.81	20.68	20.16	20.55	0.48	0.46	0.40	0.44
DRRH 2	8.50	7.70	5.70	7.30	50.0	44.3	21.4	31.43	183	176	170	176.0	20.62	20.26	20.11	20.33	0.50	0.47	0.41	0.46
Mean	8.20	7.65	5.67	—	50.0	42.6	20.3	—	183	175	168	-	18.92	18.61	18.31	—	0.49	0.47	0.41	—
CD at 5%																				
V				0.35				7.43				10.50				0.75				0.02
A				0.47				6.50				7.30				0.50				0.03
V x A				0.26				4.32				4.50				0.25				0.01

V: Varieties A: Age of seedlings Conven: Conventional method

SRI-8 days recorded higher number of tillers, filled grains per panicle, 1000 grain weight and harvest index followed by SRI-12 days and least in conventional method-21 days. Among the cultivars, BPT 5204 recorded maximum tillers per plant, filled grains per spikelets, harvest index followed by DRRH-2 and NLR 145 and BPT 3291. The interaction between cultivars and age of seedlings was significant.. From the present study it can be concluded that SRI-8 days produced maximum root ,stem, leaf ,grain ,total dry matter and yield and yield components compared to SRI-12 days and conventional method-21 days.

LITERATURE CITED

Laulanie Henri de 1993. Le systene de riziculture intensive malgache. Tropiculture (Brussels) 11.(3) :110-114

Tanaka A 1958. Studies on the characteristics physiological function of leaf of definite position on stem of rice plant Journal Science soil Manures, Japan 29:327-333

Tao long xing , Wang Xi and Min Shan Kai 2002. Physiological effects of SRI methods on rice plant. Research Report of Cornel International Institute for Agriculture food and development: 132 – 136

Thiyagarajan T M 2002. Experiments with a modified system of rice intensification in India. Research Report of Cornel International Institute for Agriculture, food and development: 137-139

Wang Sbao – bua, cao , Wixing, Jiang dang, Dai Tingbo and Zhu yan 2002. Physiological characteristics and high yield techniques with SRI rice. Research report of Cornel International Institute for Agriculture food and development: 116-124

Zhu Defeng, cheng Sbibuo, Zbang Yuping and Lin xiaping 2002. Tillering patterns and the contribution of tillers to grain yield with hybrid rice and wide spacing. Research Report of Cornel International Institute for Agriculture, food and development: 125-131.

(Received on 07.01.2011 and revised on 16.03.2011)