Leaf Senescence During Spikelet Filling as Affected by Sink-Source Balance

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Sink-Source 均衡에 따른 登熟期中 벼 잎의 老化

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The specific objectives of the study area:

To study the redistribution of assimilates during spikelet filling as affected by sink-source balance.

MATERIALS AND METHODS

Plant materials. Rice cultivar IR66 and Hankang, 2 isogenic lines (Heu and Park 1981), Wx185-25-4-5-3-1-1 (Wx185NR, normal type) and Wx185-25-4-4-2-2 (Wx185-ES, early senescence type) were used in the experiment. Three 10-day- old seedlings were transplanted per 4-liter plastic pot containing 4 kg of puddled Maahas clay soil mixed with 3 g of ammonium sulfate on 10 October 1991. Each plant was allowed to produce only 4 tillers and extra tillers were removed.

Experimental design and data analysis. The experimental design was 2 factorial Randomized Complete Block Design (RCB) with 6 replications in the greenhouse. Each two groups, Hankang and IR66; and Wx185-NR and Wx185- ES, were designated as the main plots and 4 treatments: control (intact); 1/2 of total spikelets removed (1/2 SP); 1/2 of the 1st, 2nd and 3rd leaves cut (1/2 UL) and lower leaves removed with leaf sheaths covered (RLL) on the heading date, the 4th December 1991, as subplots. Half of the total spikelets was removed by cutting the apical branch of the panicle, leaving the next two branches and cutting the next two alternately.

RESULTS AND DISCUSSION

Sink-source balance also affected leaf senescence. Unbalanced sink and source treatments like removing half of spikelets and cutting half of the leaves had a slower decrease in the CHL content than intact plants. Fertility, 100-grain weight and number of high density grains were highest in the half spikelet treatment and lowest in the half leaf treatment. Delayed leaf senescence did not result in higher grain yield per panicle. In rice genotypes differing in sink-source ratio, the photosynthetic potential is not fully realized. An increase in the sink-source ratio might result in high yield thus slow senescence up to 20 DAH is an advantage for prolonged source-sink efficiency Thus, high yield rice plant need optimum sink-source balance according to these conditions, including high rate of translocation of carbohydrate. Gifford et al. (1984) reported that genetic and chemical manipulation of light interception over the season and of partitioning offer the most potential for achieving further increases in yields.

Table 1 . Chlorophyll content of rice upper three leaf blade as affected by sink-source balance at flowering up to maturity. IRRI greenhouse 1990-1991 DS.

VARIETY	TREATMENT[1]	FLAG LEAF:CHLOROPHYLL (mg/g fresh wt.)						
		0	5	10	15	20	25	30
		(days after heading)						
Hankang	RLL		2.76a[2]	2.59c	2.74ab	2.52ab	1.68bc	1.27b
	1/2 UL		2.92a	2.83a-c	2.79ab	2.71ab	1.97a-c	1.68ab
	1/2 SP		2.75a	2.63bc	2.56b	2.28b	1.53c	1.30b
	Control	2.62b	2.76a	2.69a-c	2.47b	2.28b	1.67bc	1.25b
IR66	RLL		2.95a	2.86a-c	2.76ab	2.43ab	1.63c	1.26b
	1/2 UL		3.00a	3.01a	2.94a	2.82a	2.47a	2.01a
	1/2 SP		2.94a	2.94ab	2.72ab	2.42ab	2.19ab	1.85a
	Control	2.92a	3.00a	2.98a	2.60ab	2.31b	1.80bc	1.52ab
	CV (%)	8.41	7.97	9.27	10.06	14.45	22.21	25.57
Wx185-NR	RLL		2.87a[3]	2.91ab	2.72a	2.51b	2.78ab	2.33ab
	1/2 UL		2.93a	3.16a	3.03a	3.03a	2.89a	2.62a
	1/2 SP		2.78a	2.83b	2.73a	2.67ab	2.53a-c	2.08bc
	Control	2.80a	2.81a	2.95ab	3.06a	2.79ab	2.43bc	1.72c
Wx185-ES	RLL		2.88a	2.85b	2.77a	2.66ab	2.62ab	2.25ab
	1/2 UL		2.90a	3.15a	2.89a	2.92ab	2.85a	2.50ab
	1/2 SP		2.80a	2.79b	2.69a	2.69ab	2.58a-c	2.18a-c
	Control	2.72a	2.90a	2.90ab	2.89a	2.65ab	2.22c	1.77c
	CV (%)	8.7	5.33	7.58	11.93	11.58	11.05	17.08

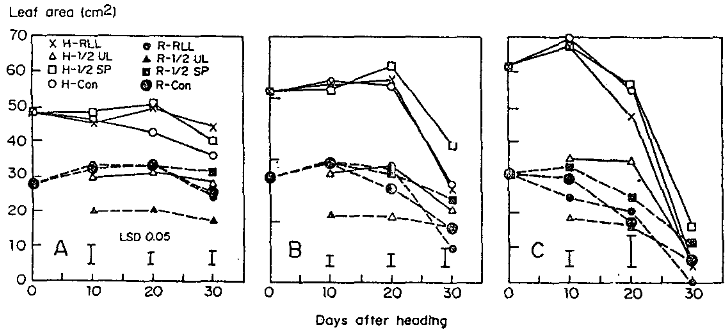

Fig. 1. Changing of the upper three leaf blade area as affected by sink source balance at flowering up to maturity in two cultivars: H = Hankang, R = IR66. IRRI greenhouse, 1990-1991 DS. A = flag leaf, B = penultimate leaf, C = third leaf.

Table 3. Increment of grain yield and components as affected by sink-source balance at flowering up to maturity in two groups, cultivars and lines. IRRI greenhouse 1990-1991 DS.

VARIETY	TREATMENT[1]	NO. SPIKELET/ PANICLE	PANICLE DRY WT. (g)				100 GRAIN DRY WT. (g)			N	FERTILITY (%)
			0	10	20	30 Day[2]	10	20	30 Day		
Hankang	RLL	108.2bc		1.60a[3]	2.11ab	2.30ab	1.93b	2.37ab	2.22ab		67bc
	1/2 UL	104.1c		1.37ab	1.88bc	2.10ac	1.88b	2.14bc	1.93b		56d
	1/2 SP	59.6d		1.30b	1.38d	1.34e	2.20a	2.60a	2.59a		85a
	Control	105.0c	0.79a	1.57a	2.40a	2.40a	1.95b	2.42a	2.24ab		70b
IR66	RLL	125.8a		1.21b	1.73c	1.98b-d	1.59c	1.82de	1.89b		63c
	1/2 UL	118.2a-c		0.92c	1.34d	1.71d	1.62c	1.70e	1.81b		53d
	1/2 SP	61.7d		0.87c	1.16d	1.07e	1.61c	1.98cd	1.96b		85a
	Control	121.9ab	0.74a	1.18b	1.90bc	1.85cd	1.56c	1.73de	1.93b		69B
	CV (%)	11.38	25.05	15.3	15.15	17.76	5.42	10.49	17.52		6.29
Wx185-NR	RLL	122.9a		1.20b	1.91ab	2.23ab	1.82ab	2.18bc	2.12de		56cd
	1/2 UL	119.7a		1.15b	1.46c-e	1.55de	1.82ab	2.16bc	2.07e		41e
	1/2 SP	64.8c		1.11bc	1.32de	1.46de	1.94a	2.30ab	2.35b		87a
	Control	120.2a	0.95a	1.42a	2.16a	2.23a	1.78ab	2.20bc	2.16c-e		69b
wX185-ES	RLL	106.8b		1.18b	1.61b-d	1.71cd	1.73a-c	2.19bc	2.21cd		58c
	1/2 UL	101.0b		1.01bc	1.23e	1.43e	1.55c	2.09c	2.15c-e		51d
	1/2 SP	52.4d		0.94c	1.17e	1.19f	1.88a	2.36a	2.44a		92a
	Control	101.6b	0.90a	1.14b	1.76bc	1.89bc	1.62bc	2.23b	2.24c		67B
	CV (%)	8.07	11.31	13.56	17.61	12.18	9.63	4.63	3.3		8.39