Most of the growth and yield characters were recorded at maturity, except for leaf area character, which was recorded at flowering stage.

Delayed planting caused significant reduction in growth parameters (plant stature, biological yield, leaf area/plant, leaf area/tiller, dry weight/tiller, and N uptake) but improved grain yield/pot because of the large increase in grains/panicle and panicles/pot, greater reduction in spikelet sterility, and greater harvest index, partitioning of N, and N use efficiency (see table).

Lopping the foliage during the vegetative phase (50 d after planting), however, depleted both growth and yield characters (stature, biological yield, leaf area/plant, leaf area/tiller, panicles/pot, and grains/panicle). Fertilization following lopping, however, markedly improved almost all growth and yield characters associated with productivity, resulting in higher grain yield/pot than lopping without applying N.

Time to maturity was reduced drastically by delaying planting until August. Grain yield could be improved substantially by transplanting C14-8 in the last week of August or the first week of September. Cutting leaves followed by 20-30 kg N/ha in early planted crops improved the productivity of C14-8. ■

Integrated pest management—insects

Relationship between farmers' early- and late-season insecticide sprays

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One of the objectives of farmers in using insecticides is to avoid yield losses due to insect pests. Thus, the number and timing of these sprays reflect farmers' perceptions of the expected impact of insecticides on production. We used farmer survey data sets from Leyte and San Jose, Nueva Ecija, Philippines, and the Mekong Delta, Vietnam, to analyze the relationship between farmers' early-season sprays and their late-season sprays.

Interview surveys using the same questionnaire were carried out in Leyte in 1990, the Mekong Delta in 1992, and San Jose in 1994. Farmers were asked to recall the timing of insecticide sprays used in the previous season. We categorized sprays applied in the first 40 d after crop establishment as early sprays and those applied later than 40 d as late sprays. The survey data were tabulated into a 2 × 2 contingency table using these two variables (Table 1). Each cell contained the frequency of occurrence of the respective attributes. We used the Pearson χ^2 test for independence to determine the association between spray early and spray late. The null hypotheses was that the two variables, spray early and spray late, are independent.

The expected frequencies for each cell from each survey site were determined by calculating the frequencies expected if no association between the two variables existed. The larger the discrepancy between these expected values and the observed values, the larger the degree of association and thus the higher the value of Pearson χ^2 (Table 2).

We used Pearson χ^2 values adjusted for a 2 × 2 contingency table to test for significance. The values were significant in all three surveys. Thus, we rejected the null hypothesis in all cases and concluded that early sprays are closely associated with late sprays.

Table 1. Frequency of early- and late-season insecticide sprays by rice farmers in Leyte and San Jose, Philippines, and the Mekong Delta, Vietnam.

	Location	Farmers (no.)		
		Spray late	Do not spray late	Total
Spray early	Leyte	213	24	237
	San Jose	215	49	264
	Mekong Delta	415	142	557
Do not spray early	Leyte	28	35	63
	San Jose	5	16	21
	Mekong Delta	84	44	128
Total	Leyte	241	59	300
	San Jose	220	65	285
	Mekong Delta	499	186	685

Table 2. Tests of independence between early- and late-season insecticide use and probabilities of farmers' spray patterns at 3 sites in the Philippines and Vietnam.

Statistics	Leyte	San Jose	Mekong Delta
n	300	285	685
df	1	1	1
χ^2	62.2	36.7	4.2
P	<0.01	<0.01	0.04
Spray pattern	**Leyte**	**San Jose**	**Mekong Delta**
Early and late	0.71	0.75	0.61
Early only	0.08	0.17	0.21
Late only	0.09	0.02	0.12
No sprays	0.11	0.06	0.06

We obtained the predicted probabilities of occurrence in each case of the contingency table for the three sites. At all sites, the probability of a farmer spraying both early and late was much higher than the probabilities of the other cases occurring (Table 2), meaning farmers who tended to spray insecticides early tended to spray late as well.

While the analysis may indicate significant association between early and late sprays, it does not provide any information on cause and effect. Farmers who sprayed both early and late may be risk averse, those who tend to use higher inputs, or those who are economically better off.

Research has shown that most early insecticide sprays are unnecessary and may be avoided. Emphasis to reduce early insecticide use may have the added value of reducing late insecticide use as well. ■