

RICE PANICLE BLANKING

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Panicle blanking, or the occurrence of "empty" kernels" on the rice panicle, may have caused yield losses of up to 12.5 per cent in 40 rice fields grown for certification in 1971. Although varieties differ in susceptibility to blanking, causes other than resistance appear to be responsible for the range in panicle blanking from 3.81 to 25.46% in different fields. Low night temperatures during pollen formation are believed to be the major cause of blanking. Pollen formation occurs during a 5-day period about 10 to 16 days before heading. Further studies aimed at finding solutions to this problem are in progress.

A PRELIMINARY SURVEY made in 1971 revealed that rice farmers may be losing up to an average of 12.5 per cent in yields because of sterile florets or "empty kernels" on rice panicles. The failure of all the florets in a panicle to become fertilized and produce kernels is usually called panicle blanking. This common condition in rice has been attributed to many causes, including low night temperatures, high daytime temperatures, and wind. The survey reported here covered 40 fields grown for certification in 1971. The fields were located in six different counties and involved five rice varieties. The percentage of blanking ranged from 3.81 to 25.46% (statistically significant at the 1% level) and averaged out at 12.49%.

TABLE 1. RELATIONSHIP BETWEEN PERCENTAGE OF PANICLE BLANKING, AND FIELD TEMPERATURES, DURING THE COLD-SENSITIVE STAGE OF CALROSE PANICLE DEVELOPMENT AT DAVIS

Cold-sensitive panicle date	Panicles observed	Five-day average temperatures*		Sterile florets %
		max. °F	min. °F	
Aug. 11	37	98.4	57.6	8.3
Aug. 16	40	98.2	52.8	12.6
Aug. 21	37	91.4	51.0	24.7

* Beginning two days before and extending two days after date of cold sensitive stage indicated.

TABLE 2. PERCENT OF BLANKING AND YIELD-PER-PLANT OF CALORO RICE, AS INFLUENCED BY DURATION OF LOW-TEMPERATURE IN THE GROWTH CHAMBER

Duration of cold treatment*	Panicle blanking %	Grain yield per plant gms
0 days	11.5	26.2
1	12.6	23.7
2	15.5	20.4
3	28.5	19.1
4	42.7	17.1
5	47.0	15.3

* 60°F during 12-hour light period and 45°F during 12-hours dark.

The type of blanking studied is shown in the photo showing some hulls to appear translucent when viewed through strong back-lighting. The condition can be easily detected in the field within about 10 days after flowering by holding the panicle up to the sun and observing that the light penetrates some kernels. Blanking of the type in which the entire panicle turns white is a different problem. This type of blanking may be caused by injury to the stem or by rapid desiccation from hot dry winds, and is especially noticeable when the white panicles occur soon after the fields are drained.

The objective of the study was not only to determine the extent of loss but if possible, the cause. Therefore, we analyzed the data by variety and by location or

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Rice panicles showing various amounts of blanking or empty kernels caused by low night temperatures during pollen formation. The dark kernels are filled while the light colored ones are empty. The panicle at the right is almost entirely fertile while the one at the left is almost entirely sterile or empty.

county where grown. The statistical analysis showed that differences between varieties and between counties were not significant. Surprisingly, there were no significant differences between varieties in 1971. An earlier test at Davis in 1970 had shown 9.06% blanking in Colusa, 11.38% in Calrose and 16.04% in Earlirose. These differences were statistically significant and in line with general observations made over the past three years. If varietal differences were present in 1971, they were masked by differences from field to field which must be attributed to environment and management.

An analysis was made of differences between fields within each variety, to determine if some varieties were more tolerant of environmental differences. Although the data were too limited for conclusive results, a statistical test indicated highly significant differences from field to field for both Calrose and Earlirose, somewhat less significant differences for Caloro, and no differences for Colusa.

The average number of florets per panicle was determined for each of the 40 fields sampled. They ranged from as low as 65 florets to as high as 233, with an average of 116 for all fields. It was clear from inspection alone that no relationship existed between blanking and number of florets per panicle.

The next question investigated was whether or not a high percentage of blanking was compensated for by larger or plumper kernels. This analysis was made by determining the 100-kernel weight from the panicles with the highest and panicles with the lowest percentage of blanking from each of 21 fields. The weight per seed on panicles with high blanking were 3% less than those from panicles showing a low amount of blanking. Thus there was no compensation of heavier kernels for increased blanks. These differences, although small, were consistent for all four varieties tested.

Our data indicated that environment or management, more than variety, in-

fluenced panicle blanking in rice fields. Excellent research in northern Japan had already indicated that low temperature was a major cause of blanking. A preliminary trial in 1970 strongly suggested that low night temperatures were also a major factor in field blanking at Davis. The Japanese had already found that the stage of plant development when rice was most susceptible to cold injury was well before heading time. It occurs when the pollen grains are just beginning to form. Under conditions at Davis this stage occurs 10 to 16 days before heading. At this time the base and tip of the panicle are about 4½ and 10 inches respectively above ground level. At Davis, this stage occurs approximately 95 to 100 days after planting with varieties such as Calrose and Caloro. This stage would be reached earlier in warmer rice growing areas.

Temperature-sensitive

The temperature-sensitive stage can be identified by the position of the collar of the flag leaf in relation to the position of the collar of the next lower leaf on the stem. The flag leaf collar is from 0 to 2 inches below the collar of the next lower leaf at the sensitive stage. For field observations, we look for the stage when the two collars are in approximately the same position on the culm.

In 1970, this method was used to determine the amount of blanking occurring during a 15-day period in late August on Calrose. Results are shown in table 1 along with the 5-day average maximum and minimum temperatures. The date of the indicated cold-sensitive stage was the mid-day of the 5-day temperature period. Panicles identified at the correct stage for sensitivity on August 11, 16, and 21 showed an average of 8.3, 12.6, and 24.7% sterility respectively. Both the maximum and minimum temperatures were declining during this period. Results indicated, but did not prove that cold temperatures were the cause of blanking.

Later experiment

A later experiment conducted under controlled temperature conditions provided further data on the low-temperature effect. Plants of Caloro rice first were grown in the greenhouse to the stage of cold sensitivity. Greenhouse temperatures ranged from 70°F at night to 90°F in the daytime. Plants were then transferred to a growth chamber reg-

ulated at 60°F during a 12-hour light period and 45°F during the dark period. The low-temperature treatments were given for 1, 2, 3, 4, and 5 days and results compared with untreated plants remaining in the greenhouse. Blanking increased from 11.5% for the untreated plants to 47% for the 5-day treatment as shown in table 2. Grain yield over this same series declined from 26.2 to 15.3 grams per plant.

The studies with the certified fields mentioned earlier suggested that local environmental conditions or management may have been the cause of differences in panicle blanking. Low temperatures, however, occur over large areas and it would appear difficult to ascribe differences in blanking from one field of rice to another to low temperatures alone. Low temperatures must occur during specific stages of pollen development in the panicle, so differences from field to field are possible. Fields are planted at different times and develop at different rates because of differences in fertility and other conditions. Therefore, fields of the same variety could reach the sensitive stage at different times.

Water temperatures may be a factor in the blanking problem. Minimum night temperatures of the water flooding the field are higher than the minimum air temperatures. The developing panicle may be protected somewhat by this 3 to 5°F warmer temperature of the water. Deeper water results in slightly higher minimum water temperatures and covers the growing panicle a little longer. Water depth, therefore, may also be related to blanking. Studies at Davis indicated a somewhat higher percentage of blanking with water depth less than 2 inches, but results with deeper levels up to 8 inches were variable and inconclusive in 1971. Further studies will be conducted on water temperatures and depth in 1972.

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TREE SHAKER THINNING OF FRENCH PRUNES

Mechanical thinning does not reduce the need for annual dormant pruning. Pruning reduces the potential crop, but more importantly it is essential for the renewal of fruit wood and in maintaining the general shape and vigor of the tree. However, this study showed that in a heavy set situation, mechanical thinning is a tool that can be used to increase average fruit size, decrease the percentage of under-size fruit, and reduce tree breakage from over-cropping.

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OVER-CROPPING AND SMALL FRUIT size are major problems in French prune orchards in California. Over-cropping can cause shoot die-back and is the most important factor contributing to small fruit size. Over-cropping can usually be prevented by adequate annual pruning. In years when the trees are not dormant-pruned or in years of extremely heavy fruit set as in 1970, fruit thinning is necessary to reduce overcropping.

Dinitro blossom-spray-thinning is one way to reduce the crop, but the spray must be applied before the set is known. A further disadvantage is that the degree of thinning can vary, depending upon uncontrollable factors such as tree vigor and weather conditions, and thus there is a danger of over-thinning. For these reasons, dinitro-blossom-spray thinning has not been widely used by growers.

Another way to prevent overcropping is to mechanically remove some of the fruit after the set is known. In the series of trials described here, two mechanical

