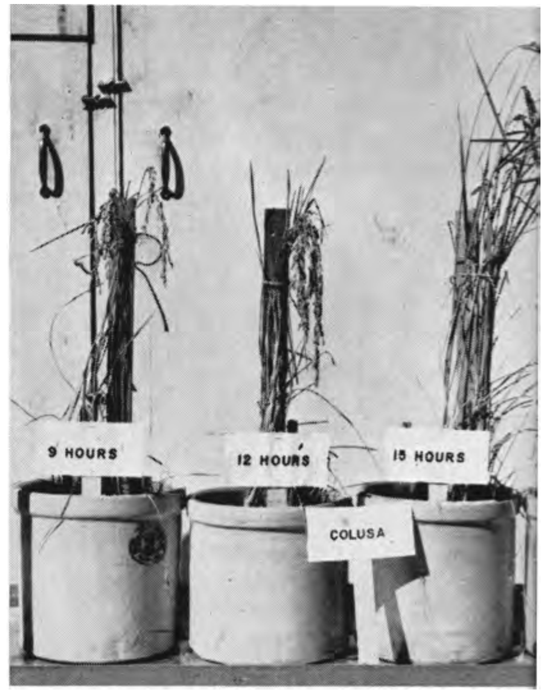
D. P. Ormrod, W. A. Bunter, Jr., D. C. Finfrock, and J. R. Thysell

Responses of Rice to photoperiod

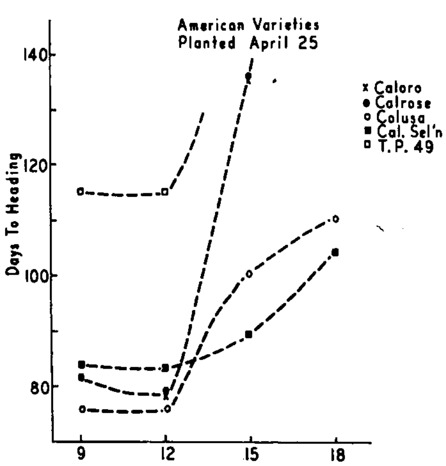


Heading of Colusa, an early variety, 139 days after planting.

Experiments indicate that photoperiod, or daylength, is of great importance in the heading of rice plants and that maturity of rice varieties can be classified in the field by their sensitivity to above-optimum daylength. Early varieties such as Colusa are less sensitive and will head in the field under the longer days of midsummer, while Caloro, a midseason variety, is more sensitive and heads in the field later in the summer after the photoperiod has shortened considerably. A very late variety such as Texas Patna 49 is highly sensitive to photoperiod and does not head until the days have become much shorter in the fall.

The rice plant goes through several phases of development. The term, juvenile state, is used to describe the early growth stage from the time of seeding until the plant will respond to photoperiod treatment. Following this, photoperiodic induction can occur if satisfactory conditions of photoperiod are provided. This stage is followed by inflorescence growth and development, heading, flowering, and finally, development of the grain.

The first evidence of photoperiodic induction can be found as inflorescence initiation at the shoot apex. This stage occurs a considerable length of time before the head appears above the flag leaf, and in order to observe it, the apical region must be removed, with consequent loss of the plant. Thus many plants are required if frequent checks are to be made. Other investigators have found that photoperiod does not affect rate of development of the inflorescence. That is, heading can be considered to occur a constant number of days after initiation, regardless of photoperiod. For this reason, heading date was used rather than inflorescence initiation, to allow fewer plants per treatment and more treatments and entries in the experiment.

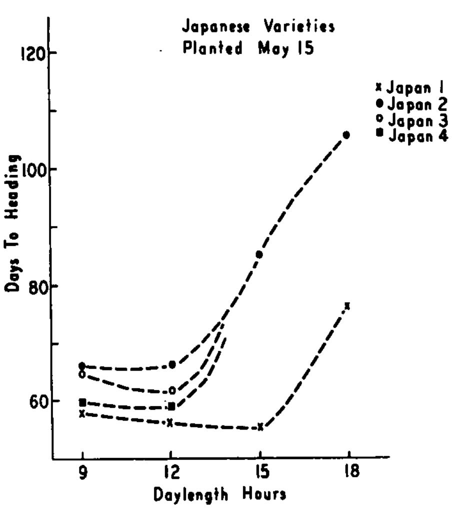


Heading response curve for the American varieties in the experiment.

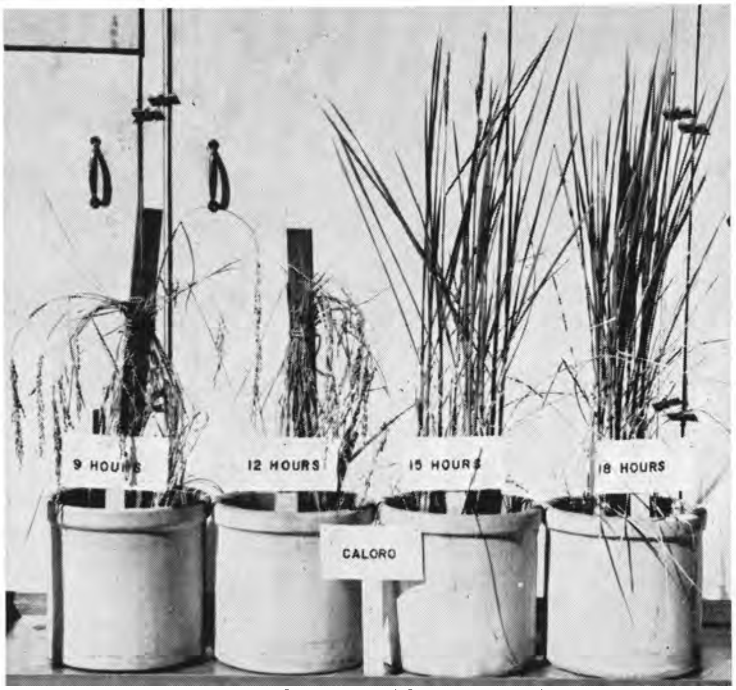
On April 25, 1959, seed of five rice varieties was planted in 2-gallon pots fertilized with the equivalent of 45 pounds of nitrogen per acre. Four Japanese varieties were planted on May 15, 1959. The plants were later thinned to four plants per pot. Daylength treatments were begun immediately after seeding, with nine hours of natural sunlight provided for all pots and 0, 3, 6, and 9 additional hours of artificial light provided in closed chambers to give total daylengths of 9, 12, 15, and 18 hours. The pots were set on carts to facilitate movement out of the controlled daylength chamber at 8:00 a.m. and back into the chamber at 5:00 p.m. each day. An additional set of pots was placed outdoors as an indicator of the effects of natural daylength. A forced-air ventilation system prevented heat build-up by lights in the chambers.

The response curves of the nine varieties are shown in the accompanying graphs. For most of the varieties tested, there appeared to be an optimum photoperiod of about 12 hours. Further experiments with intermediate daylengths may reveal more critical information on this optimum. Some varieties are highly sensitive to photoperiod while others are much less sensitive, as indicated by the slope of the response curve. The steeper the slope above the optimum, the more sensitive a variety is to photoperiod. The slight slope of the curve below the optimum daylength probably indicates that very short days delay heading because of limiting amounts of photosynthate in the plant.

Caloro, a midseason California variety, is quite sensitive to photoperiod. Fifty-seven additional days of growth were required after heading in the 12-hour day before the plants headed in a 15-hour day. The response of Calrose, another midseason California variety, was similar to that of Caloro—its main parent. Colusa, an early California variety, required only 24 additional days before heading in the 15-hour day, and 10 more days to head in the 18-hour day. Colusa thus showed much less sensitivity to longer days than did Caloro or Calrose. An early selection of Calrose was even less sensitive than was Colusa. Texas Patna 49, a southern variety which



Heading response curve for the Japanese varieties in the experiment.



Heading of Caloro, a midseason variety, 139 days after planting.

Heading of Texas Patna 49, a late variety, 139 days after planting.

is very late in the field in California, headed in short days after 129 days, but did not head under longer days before the termination of the experiment. This variety apparently has a very long juvenile stage before photoperiodic induction can occur.

The late-planted four Japanese varieties behaved in a similar fashion to American varieties — heading response being definitely correlated with earliness in the field. Japan 1—Eikou—had its optimum photoperiod at about 15 hours in contrast to all other varieties tested. This variety, which is very early when field-planted, was thus quite insensitive. Japan 2—Oba So—early in the field, was more sensitive to daylength, heading 19 days later in a 15-hour day and 20 days later in an 18-hour day. Japan 3—Yamanaka No. 2—and Japan 4—Miho No. 111—while heading rapidly under optimum short days, were very sensitive to daylength and did not head in longer days. This reflected their classification as late varieties when field-planted.

Many other growth characters of the plants used in these experiments were observed. Germination and emergence of the seedlings appeared to be independent of daylength. Also, no trends were indicated in effects of daylength on the amount of tillering, the average height at full heading, or the grain and straw yields of the plants. The number of kernels per head was affected in some varieties, with increasing kernel numbers corresponding to increasing daylength.

D. P. Ormrod is Junior Agronomist, University of California, Davis.

W. A. Bunter, Jr. is Laboratory Assistant, University of California, Davis.

D. C. Finfrock is Associate Specialist in Agronomy, Biggs Rice Experiment Station, University of California.

J. R. Thysell is Research Agronomist, ARS, USDA, Rice Experiment Station, Biggs.

The above progress report is based on Research Project No. 176A.

LOUIS K. MANN

Nematode-free

Garlic Planting Stock

Plants propagated vegetatively, rather than by true seed, frequently carry diseases in the vegetative parts. One of the diseases of garlic, the stem and bulb nematode, is carried in the cloves and ~~has become widely established.~~

The stem and bulb nematode, a tiny worm hardly visible to the naked eye, invades the leaf tissues of garlic and may seriously reduce yields. It is a difficult disease to control because lightly infested bulbs showing no symptoms may be planted into clean land. Once introduced into a field, the stem and bulb nematode, which also infests such weeds as miner's lettuce and nightshade, may persist in the soil for many years.

~~Soil fumigation commonly increases~~ yields on heavily infested land, but it is expensive and does not completely eradicate the pest. As yet no satisfactory method has been found to kill the nematode in the garlic cloves of planting stock.

In 1950, workers at Davis selected for experimental work, a number of lines of California Late garlic from commercial fields. After several years of selection, nematode-free planting stock became available for planting on clean land in an effort to produce planting stock for commercial use. Lassen County established an ordinance to prevent uninspected garlic from being planted in the county, and a program for certification of nematode-free planting stock has been established by the State. Other areas in California where clean land is available are organizing to produce certified planting stock. The first planting stock for commercial production is expected to become available in the autumn of 1960.

Louis K. Mann is Professor of Vegetable Crops, Department of Vegetable Crops, University of California, Davis.