vestigation, 10 were copper chlorophyllins, 3 were iron chlorophyllins, and 1 was not specified. These were produced by 7 different manufacturers. Varying amounts of each were dissolved and examined in 0.1 *M* KCl solution and in a solution 1.5 *M* in ammonia–ammonium chloride.

The following results were obtained: (1) Reduction in 0.1 *M* KCl: a reduction wave, characteristic for all the chlorophyllins examined, was obtained at an $E_{1/2}$ ranging from -1.22 to -1.38 v and the average $E_{1/2}$ was -1.26 v. Three chlorophyllins gave two additional waves and two gave one additional wave. The $E_{1/2}$ of these waves varied greatly.

(2) Reduction in 1.5 *M* ammonia–ammonium chloride: 11 of the chlorophyllins gave a characteristic wave with the $E_{1/2}$ ranging from -0.89 to -1.03 v, and the average was -0.98 v. A 12th gave a long drawn-out wave which was not measurable.

(a) Nine of the ten copper chlorophyllins gave two additional waves at an $E_{1/2}$ of -0.26 and -0.53 v, respectively. Five of these gave another wave, though poorly defined, at an $E_{1/2}$ ranging from -1.25 to -1.43 v.

(b) The 3 iron chlorophyllins showed a characteristic wave at an $E_{1/2}$ of -1.52 v.

The characteristic waves mentioned in 1 and 2 above are proportional to the concentration of chlorophyllin in each case.

The waves of the copper chlorophyllins at $E_{1/2}$ of -0.26 and -0.53 are believed to be caused by unreacted copper ions used in the manufacture of the chlorophyllins and not completely removed. In a like manner, the wave at -1.52 for the iron chlorophyllins is assumed to be caused by iron not completely removed after the manufacture of the iron chlorophyllins.

It is also our belief that the additional waves appearing in a few instances are due to other impurities that are not removed in the manufacturing procedure.

The reduction wave at $E_{1/2}$ of -1.26 obtained in KCl solution is proportional to the concentration of chlorophyllin in solution in each case, indicating that a component of the commercially available chlorophyllin reacts at the dropping mercury electrode. However, no correlation exists between the height of the diffusion current and the percentage of chlorophyllin stated on the label of the individual chlorophyllin. For example, calculation of the concentrations from the resultant diffusion currents obtained for 80 mg of each of the 14 chlorophyllins does not agree with the concentration as determined by the New and Nonofficial Remedies or Association of Official Agricultural Chemists' methods. The most logical conclusion drawn from this difference is that the polarographic method measures a different component than the other currently available methods. We are tentatively ascribing this reduction wave to the chlorophyllin *b* fraction present in the commercial chlorophyllins since it contains an aldehyde grouping that is presumably reducible at the dropping mercury electrode. However, it is possible that this wave may be due to some other fraction or fractions present since the chlorophyllins are mixtures of several substances as pointed out by Eddy (*4*) and by Voigtlander and Henning (*5*).

Further experiments may ascertain which of these fractions is responsible for this reduction wave.

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Photoperiodic Response of Some Indian Wheats[1]

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The materials of the present investigation are two newly evolved strains of Indian wheat. Ranjan (*1*) exposed the seeds and seedlings of the wheat New Pusa 52 to x-ray treatment and evolved 11 mutants. He subjected them to genetical studies for 8 yr and established the superiority of some of them over the local popular varieties. Pugh (*2*) grew them in large-scale field experiments under varying irrigation conditions and showed that of the 11 strains, two, R-1 (sarojini) and R-9 (Vijaya), are undoubtedly the best. Bhattacharya (*3*) and Ramchander and Bhattacharya (*4*) studied some of the biochemical and physiological aspects and showed that these two strains are higher in some of the protein and mineral contents than the parent wheat N.P. 52. The present investigation is designed to determine whether the photoperiodic response of these two mutants follows the general trend of the other Indian wheats and to note their stage of optimum response to photoperiods. In this study, no other Indian variety of wheat is included because their photoperiodic responses have already been noted by other workers (*5–7*). As long-day treatment, a 24-hr continuous illumination and as short-day treatment, an 8-hr photoperiod were used. The method of obtaining these different photoperiods is the same as in previous work (*8*).[2]

[1] Grateful thanks are due to Shri Ranjan for his guidance, helpful criticism, and for the facilities provided in the Botanical Laboratory of Allahabad University for carrying out this piece of investigation.

[2] The 24-hr photoperiod was obtained by supplementing the natural daylight with artificial illumination from a 1000-w gas-filled Osram bulb hung at a height of 5 ft from sunset to sunrise, giving an intensity of approximately 30–40 ft-c at the soil surface of the pot. The 8-hr photoperiod was obtained by keeping the pots in daylight from 8 A.M. to 4 P.M. and then by removing them to a well-ventilated dark room for the remainder of the 24-hr cycle.

TABLE 1

TIME FROM SOWING TO EAR EMERGENCE OF THE MAIN SHOOT IN R-9

Treatments	Average number of days from sowing to ear emergence	Difference from control in days*
Long-day to 8-day-old seedlings		
8 days	62.83	+ 7.42
16 days	59.70	+20.55
24 days	50.58	+19.67
32 days	47.12	+23.13
Long-day to 16-day-old seedings		
8 days	62.00	+ 8.25
16 days	55.12	+15.13
24 days	52.95	+17.30
Long-day to 24-day-old seedlings		
8 days	63.12	+ 7.13
16 days	61.16	+ 9.09
Long-day to 32-day-old seedlings		
8 days	64.58	+ 5.67
Short-day to 8-day-old seedlings		
24 days	83.37	−13.12
32 days	87.54	−17.29
Long-day to 8-day-old seedlings 24 days followed by 24 short days	51.58	+18.67
Short-day to 8-day-old seedlings 24 days followed by 24 long days	60.70	+ 9.55
4 cycles of 8 long days alternated with 8 short days beginning with 8-day-old seedlings	61.33	+ 8.92
8 cycles of 4 long days alternated with 4 short days beginning with 8-day-old seedlings	59.37	+15.88
16 cycles of 2 long days alternated with 2 short days beginning with 8-day-old seedlings	60.62	+ 9.63
32 cycles of 1 long day alternated with 1 short day beginning with 8-day-old seedlings	58.33	+11.92
Control which received natural day length available in the open field throughout	70.25	

S.E. of treatment mean = 0.46; C.D. at 5% of treatment mean = 1.27.

S.E. of individual mean = 0.64; C.D. at 5% for comparing two individual means = 1.80.

* Sowing date November 22, 1949. + indicates earliness. − indicates delaying effect.

The time from sowing to heading is presented in Table 1. From the data presented it is seen that long-day treatment shortens the vegetative period. This is so for all ages of seedlings considered and for both varieties R-1 and R-9. Even an exposure to long-day conditions for a short period of 8 days was sufficient to induce only an earliness of 5–8 days in both the varieties. As the duration of the treatment increases from 8 to 32 days there is a gradual decrease in the vegetative period. The maximum earliness of 23–25 days in the time to ear emergence is observed when the long days are given to 8-day-old seedlings for 32 days. With regard to the age of the seedlings at which the long-day treatment is more effective, it is found that when only 8 long days are given, the age of the seedling has practically no effect because the same degree of earliness is obtained whether the seedlings are 8, 16, 24, or 32 days old at the beginning of the treatment. If the seedlings of various ages are treated for prolonged long days, more earliness is seen in those which were young when the treatment began. In other words, the older the seedlings when treated, the less effective are long-day photoperiods of uniform length in inducing earliness. Hence, for obtaining maximum earliness in these two varieties the age of the seedlings should be between 8 and 16 days.

The control plants had to pass this developmental phase (photophase) under available natural short-day conditions of approximately 10–11 hr of the tropics; hence the delay in ear emergence in these plants in comparison with the plants which received long days during that stage. When this available normal light period was further curtailed to 8 hr it was found that the time of ear emergence was considerably delayed from that of the control plants. Thus it is seen that 24 or 32 short days have delayed the ear emergence by 13–17 days. When 24 long days have been given to 8-day-old seedlings the earliness achieved is about 19–23 days. When the same number of long days is followed by 24 short days, it is interesting to note that the same amount of earliness is obtained. When 24 short days are given to 8-day-old seedlings a delay of about 13 days is noticed. When these 24 short days are followed by 24 long days, there is earliness of 9–12 days. Further, in a 32-day cycle when various cycles of long days and short days were given, it was noted that the plants flowered essentially at the same time. These results can be explained by the assumption that the changes which occur in the plants as a consequence of exposure to favorable photoperiods for a certain duration (a length of time insufficient to produce flowering) result in some irreversible changes which persist through subsequent durations of exposure to unfavorable photoperiods; so that when the favorable photoperiods are reestablished the process seems to take up where it left off.

The investigations (7) carried out at New Delhi and Simla have shown that in the varieties of English wheat—Holdfast, Little Joss, Yeoman, Juliana and Yorkwin—chilling followed by long days greatly increases the earliness. The interesting point is that in the absence of chilling, long days have no effect. The picture is different for Indian varieties of wheat. In the two strains of mutant wheats R-1 and R-9 as well as in other varieties of Indian wheats, N.P. 52, N.P. 4, N.P. 165, N.P. 114, long days alone bring about a significantly earlier ear emergence.

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