A variance increase can be noted for plants which received red light interruptions toward the end of the dark period whereas score deviations are greatest for plants which received far-red interruptions early in the dark period. The data suggest red light, applied early in the dark period, has a greater probability of conditioning the R' expression to a lower level of expression in the W22 Inbred. Far-red has the opposite effect of red light and is most effective when applied toward the latter part of the dark period.

The difference in effect of red and far-red on R' expression is of that reported for various L:D treatments at early stages of development.

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2. Heritable differences in paramutant R expression after one growing season in different latitudes of the United States.

In previous reports, MGCNL Vols. 41, 42, 43, we have shown that heritable levels of R' (paramutated R) expression are conditioned by light-dark cycles applied early in development. It seemed likely, therefore, that different levels of R' expression could be conditioned by natural environments if RR^{st} plants were grown out one season at different latitudes. Such latitudinally induced heritable differences in gene expression would pose a very interesting challenge to existing biological dogma regarding sources of genetic variation for evolution. To test the hypothesis that one growing season in a different environment can make a heritable difference in a gene expression, a common lot of seed was divided and distributed to each of six locations across the latitude of the United States.

Seeds of Inbred W22 RR^{st}, from a cross involving a single pollen parent of RR to $R^{st}R^{st}$ female sib plants, were distributed to Wisconsin, Illinois, Iowa, Texas, and a final sample was grown in Ohio (a Missouri sample was lost because of adverse weather conditions). At each of the localities named above the Inbred W22 RR^{st} plants were testcrossed to Inbred W23 rr. The hybrid seed (W22 and W23) was then returned to Defiance, Ohio to be grown out and testcrossed to assay the level of R' expression.

Seeds of six ears returned from each geographic area were pooled and replicate field plantings were made for each of the five areas. The R'r hybrid plants were testcrossed to highly Inbred W22 rr; six testcross ears from each replicate planting were scored (total of 12 ears representing each geographic locality). 50 R'r kernels were removed from each testcross ear and compared against a set of standard kernels ranging from colorless, score of 0, to completely pigmented, scored 22. A mean kernel score for each ear was determined and from this a mean ear score for each geographic locality was computed and compared, by means of the t-test, with each of the scores from other localities.

Analysis of the results of Table 3 shows that a significant difference between R' expression from Texas and Wisconsin exists, $P < .001$. A significant difference was also found when plants from seeds produced in Texas were compared with those from Iowa, Illinois or Ohio, $P < .01$. Scores of R' expression from seeds derived from Wisconsin approach the margin of significance when compared with Iowa, or Illinois, $P < .02$ and $< .06$ respectively.

It is remarkable, therefore, that one season at a given latitude within the United States can make a measurable, heritable, input into the expression of a single gene. It is known that native plant populations across the latitude of the United States can differ morphologically, physiologically and genetically. Accounting for the source of such variation, however, can make very stringent demands of a biological system, experimentally. Few systems can satisfy the demands for accounting for sources of variation and, as a result, it is commonly assumed that the latitudinal differences observed in native plant populations are the result of long periods of time. The experimental results reported here suggest that certain gene combinations, active at critical periods of development, could have much greater flexibility and responsiveness to environmental conditions than existing interpretations of experimental evidence permit. From the information on the R locus, it appears that genes or gene complexes with the capabilities of paramutant combination, RR^{st}, could show all the necessary requirements for data processing for evolutionary purposes--such as gene complex could receive, store, sum

Table 3

Comparison of R' expression from RRst plants raised in different areas. Ear mean scores of R' from testcrosses of R'r hybrid plants raised the previous year in five states across the latitude of the United States.

Wisconsin	Ohio	Illinois	Iowa	Texas
20.02	19.88	17.02	17.68	15.32
19.98	21.10	18.90	18.96	15.18
18.52	19.48	18.56	17.68	17.48
19.02	18.77	19.50	19.24	17.46
18.50	18.84	18.41	19.88	15.82
19.72	17.98	18.88	19.18	17.52
19.53	21.20	19.64	18.72	15.66
18.68	19.44	16.87	19.70	16.02
20.94	16.82	16.76	19.22	17.30
19.66	18.42	19.10	19.13	18.86
20.54	17.12	21.48	18.08	18.76
21.18	19.66	19.62	17.14	17.96
19.69	19.06	18.73	19.24	16.95
			18.76	

and feed back information--in short, it could have all the important qualities of a "modern", "responsive" genetic system worthy of a higher plant.

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