Table 1
Districts of Peru where the Diffuse gene has been identified

District	Map locations*	Number of locations
Ancash	9° - 78°	13
Apurimac	14° - 73°	1
Cajama	7° - 79°	1
Huancavelica	13° - 75°	1
Huanuco	9° - 74°	2
Junin	11° - 75°	2
La Libertad	8° - 79°	1
Piura	5° - 80°	1
Puno	16° - 70°	1

*Degrees latitude south of the equator - degrees longitude west of Greenwich

In the Ancash District this was not the case. Totally green plants constituted a large proportion (approx. 20%) of one population examined. The mutable form of Idf was found on only one plant. These results from Ancash were unexpected, based upon laboratory experience. The most frequently found state of Idf is the mutable form, unless selection for other states is made. The fully active form is highly unstable, progressively reverting to the mutable form in subsequent generations. It was found that the farmers in Ancash region prefer two types of ears--"Blanco" (white) and highly colored (every pericarp color gene known). One way to have "Blanco" is to lose the major dominant pigment conditioning genes (but they are almost always present), or to select for a dominant pigment inhibitor--the fully active form of Diffuse. Such a selection by the farmer would account for the high frequency of fully active Diffuse.

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2. A possible selective advantage of plant color at high altitudes.

Field observations and temperature measurements of three high altitude corn fields in Peru have disclosed the following (statistical analysis of the temperature measurement is not as yet complete):

1. There seems to be a very high correlation of both (a) high frequency of plant color, and (b) low ear and plant size with low temperature

growing conditions. When air temperatures are low for the 8 month growing season the frequency of heavily pigmented plants is about 96% (pigment is present in the leaf sheath, stem and ear husk but not obvious in the leaf). The ears are so close to the ground that the ear nodes may be below ground. When air temperatures are not limiting (12 month growing season), the colored plant frequency falls to approximately 65% and the plant and ear heights are considerably higher (ears three feet above ground).

2. Colored anthers (dark red or purple) are present in low frequency in contrast to the high colored plant frequency.

3. Agricultural practices are such that no human selection is made for or against plant color directly. Strong and varied selections are made for kernel (endosperm, aleurone and pericarp) pigmentations. The active form of the major pigment inhibitor, Diffuse, would be the only recognized factor selected for kernel effects which would also modify the plant coloration significantly. This active dominant pigment inhibitor was expressed in 23% of the plants in the field where temperatures were not limiting and was totally absent in the two "cold grown" fields. Plant size and planting density under native growing schemes are such that the whole body of the plant is exposed to direct sunlight.

4. Direct temperature measurements by thermister probes (sensitive to 0.10°C) of intensely colored and nearly green plants were made at the same time. The data involve measurements from, (a) the center of the ear at the time of pollination and one month after, (b) the husk surface, (c) the internal stem at the height of the ear, and (d) the stem surface. At all positions of the plant the dark colored plants were warmer than the near green. Dark colored plants were from 0.5°C - 3.5°C warmer than the near green when the sun was on the plant. In early morning both kinds of plants were the same. At night or when air temperatures were dropping the center of the ear and center of the stem were warmer in the colored than in near green plants. When the sun was heating the plants they were above air temperatures and remained so for long periods after heating stopped.

5. Conclusion: When air temperatures are low during the day the plants obtain the needed heat directly from the sun and the dark colored plants do this better than the near green plants. The larger the plant structure, the ear especially, the longer the higher temperatures remain elevated as compared with the more exposed portions of the plant. Thus, the genes for dark plant color (<u>B</u> and <u>Pl</u>) appear to be selected for by this greater heat uptake. While this appears to be the case for plant color, the opposite seems to be the case for anther color.

Night temperatures at these very high locations are very low for corn culture. It is believed that the short plant and low ear height are adaptive features which bring the plant closer to the major heat sink available--the soil.

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