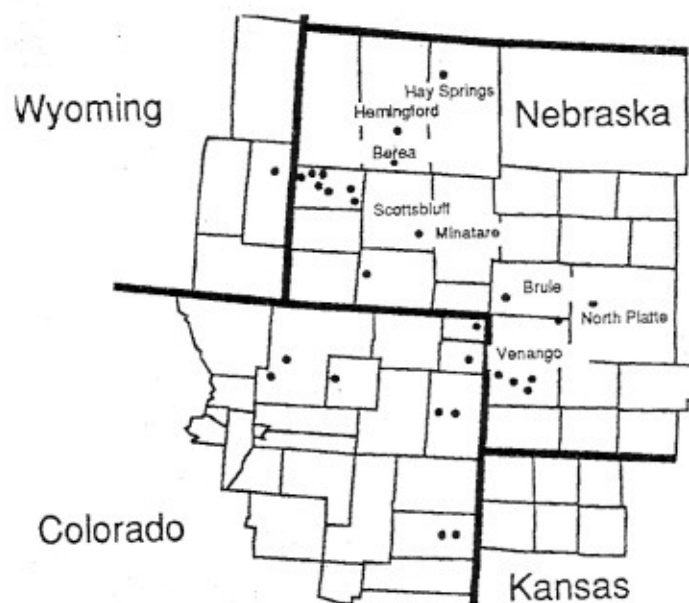


Factors influencing differentiation of Pinto Bean seed testa yellowish discoloration

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University of Nebraska

In 1996, researchers from University of Nebraska, University of Wyoming, Colorado State University, and Kansas State University, conducted trials to observe the varietal performance of pinto beans under commercial field conditions. There were 33 trial sites located mainly in Western Nebraska and Eastern Colorado.

Figure 1. Map of the trial sites

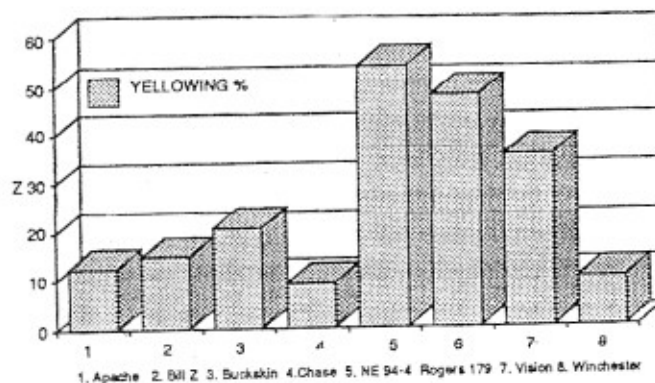


Pinto beans, particularly NE 94-4 (WM2 94-4), showed seed coat discoloration. The following 8 sites in Nebraska, were affected in 1996; Hay Springs, Hemingford, Berea, Scottsbluff, Minatare, Brule, North Platte, and Venango (Figure 1). Again in 1997, the same discoloration, involving a pronounced yellowing of the seed, was observed in many trial sites. Figure 2 shows some important pinto bean varieties and the associated discoloration measured as percentage of the seed coat showing a yellow pigmentation in 1997.

The yellowing of NE 94-4 was a surprise as over the years, Dr. Dermot Coyne's breeding program has selected lines with a typical pinto color. Therefore, environmental or cultural factors probably caused the beans to discolor.

The main purpose of this research, conducted by the senior author for the M.S. degree, will be to determine the cause of testa yellowing. This will be done by investigating color pigments in the dry bean testa as well as simulating external factors, such as rain and humidity, that may influence testa color.

Figure 2. Eight pinto bean varieties and the percent yellowing of the seed coat.



The graduate committee for my research is Dr. Ellen Paparozzi, whole plant physiologist (Chair); Dr. Dermot Coyne, bean breeder and geneticist, Dr. Durward Smith, post-harvest physiologist and Mr. David Nuland, extension specialist.

The first step was to examine data prepared by Mr. David Nuland from the collaborative on-farm trials. The weather data of the 8 affected trial sites in NE, were graphed and compared. The following factors were associated with discoloration: hail, method of irrigation, and high temperature.

Hail. Five of eight trial sites in Nebraska were hailed during the growing season 1996. Therefore, hail may affect the discoloration of the bean. The affected sites were Minatare, Scottsbluff, Berea, and Hemingford.

Method of irrigation. In five of the eight trial sites which had pronounced seed coat yellowing, the sprinkler irrigation method was used. Thus, sprinkler irrigation may cause the discoloration as a moisture factor. The trial sites in which sprinkler irrigation was used were North Platte, Venango, Scottsbluff, and Hemingford. In the rest of the sites, furrow irrigation was the method used.

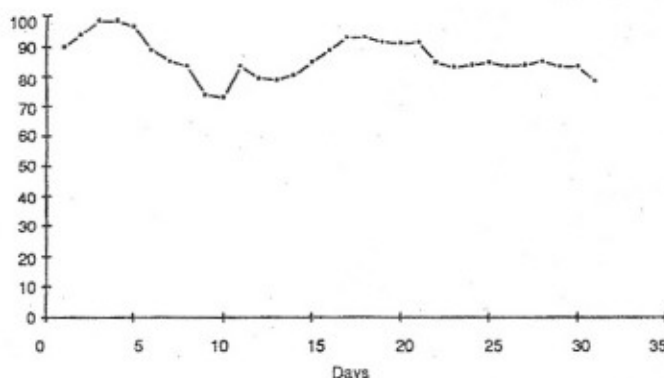
High temperature. In July 1996, two high temperature peaks were observed in all trial sites (Figure 3). The first peak was between 1st and 6th, and second peak was between 17th and 22nd July, 1996.

High temperature peaks were again observed at these trial sites at the beginning of September 1996.

In addition to the weather data, a preliminary examination of field plants (1997) was conducted at trial site in Scottsbluff. During harvesting of these plants only half of trial was cut and harvested. The other cut plants were left on the ground in the field, and were rained upon. We examined seeds from the pods of the plants that touched the ground versus seeds from pods from cut plants that were left upright, and found that the seed from the former pods showed more discoloration than the seed from the latter pods. Yellowing was measured visually by determining percent of the yellowing area on a bean seed.

In the greenhouse, we will try to simulate different weather conditions in relation to seed coat discoloration. Greenhouse experiments will be conducted to explore (a) the effect of moisture on the pods, (b) the effect of injection of water into the pod, and (c) the effect of moisture on seeds extracted from the pods. In the first experiment, to verify the effect of moisture on the pods, two varieties, NE 94-4 (susceptible in seed coat yellowing) and UI 114 (control) will be used. One week before harvesting, the

Figure 3. High temperature (°F) in Minatare July 1996.



following treatments will be applied: half of the plants will be misted every day for one hour, and the half unmisted used as a control. Seeds in the pods on different parts of the plants will be examined for seed coat discoloration under the two treatments.

The second greenhouse experiment involves the effect of injection of water into the pods. The same two genotypes will be used. Some pods will be injected with water a week or two prior to harvest. The other pods will be either injected

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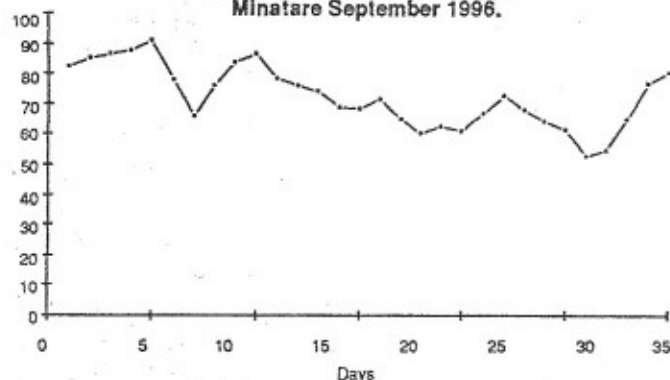
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Figure 4. High temperature (F) in Minatare September 1996.



(injured only) or used as a control. Seeds will again be examined for seed coat discoloration.

In the last experiment, pods from control plants of the previous experiment will be harvested before maturity. Half the seed from these pods will be set in moist dark environment and half will be kept in a dry dark environment. Seeds will be examined every two weeks to see if and where yellowing occurs.

Pigments will be extracted from the seed coats. A simple crude extract will be used to investigate the yellow pigments. If necessary, High Performance Lipid Chromatography (H.P.L.C.) will be used. The yellowing can be due to a number of different pigments such as xanthophylls, carotenoids or tannins. We hope we will be successful in determining which compounds are involved. 

*The pessimist complains
about the wind;*

*The optimist expects
it to change;*

The realist adjusts the sails.

—William Arthur Ward

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