Blood-Spotting in Eggs

controlled by breeding in a ten-generation selection experiment with Single Comb White Leghorns

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Blood-spotting in chicken eggs can be controlled by breeding. Heredity is the most important known factor responsible for the tendency of birds to produce blood-spotted eggs. To study the influence of genetic differences between birds with respect to this common defect, a selection experiment was undertaken.

Ten generations of breeding a line of Single Comb White Leghorns for blood-spots resulted in a 38-fold increase in the percentage of eggs showing blood in the albumen.

The eggs of the original flock in 1938 showed .6% with blood-spots detectable by candling. In 1948 the specially selected line produced eggs of which 22.8% were detected to have blood-spots. During the same years, the production line which was selected against blood-spotting showed a slight increase in percentage of blood-spotted eggs, but never exceeded 1.35%.

Managemental factors—such as rations fed—varied from year to year, but within each year the stocks of the production and the selected blood-spot lines were hatched in the same incubators, reared under the same brooders, housed together and fed the same rations during the laying year, and had the same management.

All intact eggs laid were candled; there was some evidence that the accuracy of detection of blood-spots increased in later years of the experiment. All eggs suspected of carrying a spot were broken to verify the presence of blood. Probably many small spots were not detected.

The blood-spot line was started in 1939 by removal for breeding of those families from the production line of 1938 that had a relatively high incidence of blood-spotting. Until 1945, birds mated in this line were yearling hens having a high blood-spotting percentage based on the complete pullet year record and one to three cocks from families producing a high average percentage of blood-spots. This selection procedure resulted in practically two separate sub-lines being selected for blood-spots, since birds bred in 1941 produced a generation from which breeders were chosen for mating in 1943, and similarly 1942 breeders produced the generation of birds bred in 1944.

By 1945 the blood-spotting tendency increased to such a high level that it could be detected—with sufficient accuracy—from early records in time to breed pullets and cockerels each year. The two sub-lines then merged gradually.

Additional families of birds were removed from the production line and added to the breeding flock in the blood-spot selection in several years, the latest in 1947. By this procedure the inbreeding of the blood-spot birds was kept within a 10% level, slightly lower than that of the production line, without apparently restricting the progress toward higher levels of blood-spotting.

Reciprocal crosses between blood-spot and production lines were made in 1947 and 1948. The blood-spotting incidence in eggs produced by pullets from these matings was intermediate between the parental stock levels. Since only a limited number of pullets were produced, the difference between the reciprocal crosses can not be considered significant.

Various estimates of the heritability of blood-spotting in the University flock gave an average value of about .5. This

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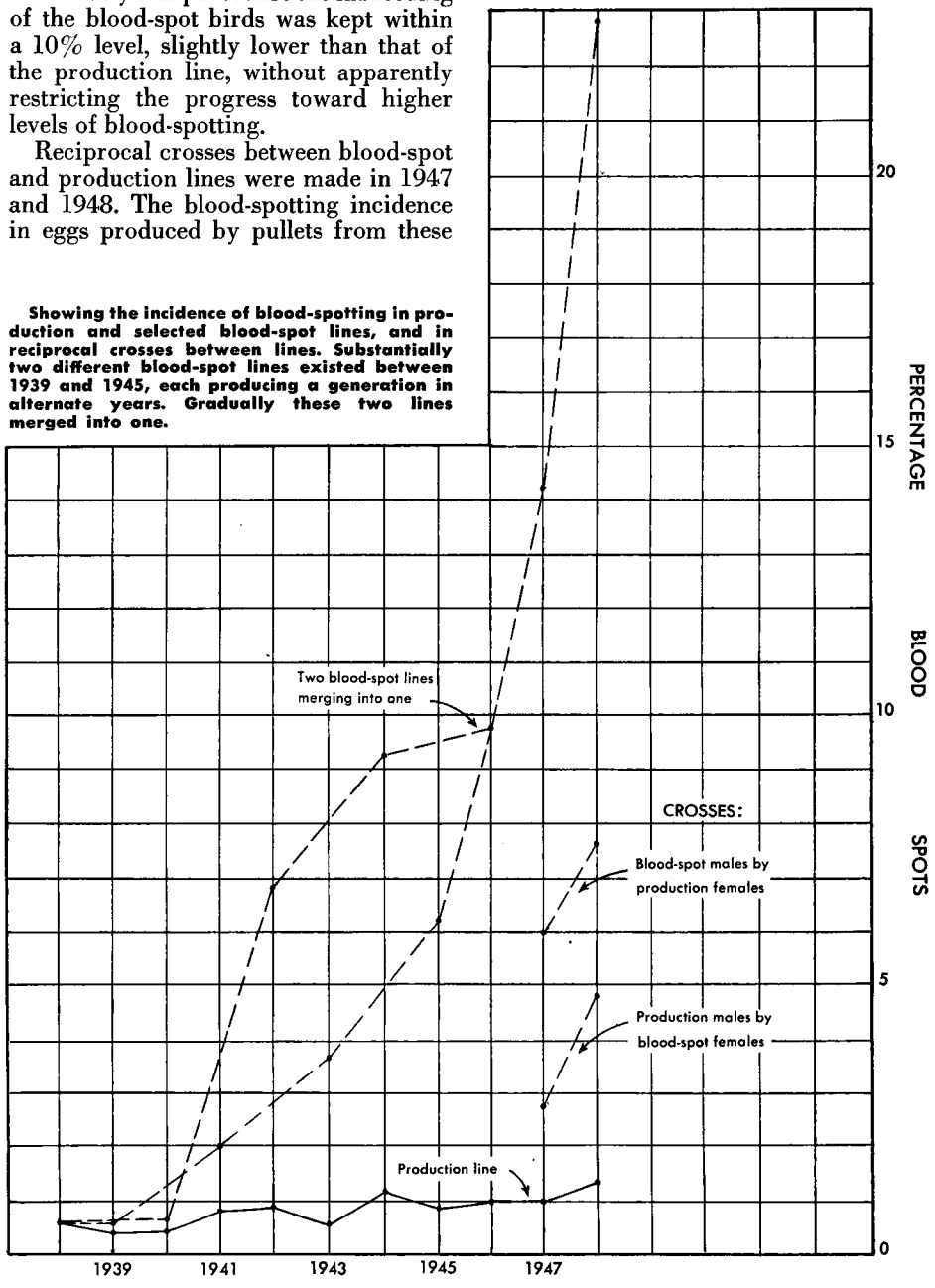

Showing the incidence of blood-spotting in production and selected blood-spot lines, and in reciprocal crosses between lines. Substantially two different blood-spot lines existed between 1939 and 1945, each producing a generation in alternate years. Gradually these two lines merged into one.

Nontoxic Ferns

feeding tests with cattle find gold fern, bird's foot fern nontoxic

K. A. Wagnon

No evidence of toxicity was found in gold fern and bird's foot fern, two plants suspected to cause jimmies—or jitters—in cattle moved to and from mountain ranges.

The condition is also reported in animals grazing in the mountains and sometimes on foothill range.

It is possible, however, that the two ferns are toxic only in certain years as was observed in feeding tests with bracken fern.

Descriptions of symptoms of the disease vary, but the most consistent characteristics are staggering gait, muscular tremors, and collapse after exertion. Muscular inco-ordination in rear quarters, labored respiration, apparent visual impairment, and frequent urination are also described.

Recovery in most cases follows if the animals are left undisturbed and not forced to travel or to become excited. Death sometimes occurs from prostration with animals headed down hill. Bloat is the immediate cause of death.

Plant toxicity is usually suspected. Among the plants indicted are certain lupins, parsley, laurel, skunk cabbage, buckeye, oak leaves, moss, and ferns. Of the latter, gold fern and bird's foot fern are suspected particularly in some of the lower foothill elevations. Bird's foot has been reported to be poisonous to sheep.

Because solution of the cause or multiplicity of causes for jimmies appears to rest upon trial and error methods and by process of elimination, feeding tests were run with cattle on the San Joaquin Experimental Range.

Both gold fern and bird's foot fern produce new frond growth in the spring. Before spore maturation, the fronds dry out and remain dormant through the dry summer and fall. They revive with the onset of autumn rains, and the spores mature. Then, having completed the cycle, they die. Since toxicity in both developmental stages has been suspected, both the desiccated and the revived forms were tested.

Eight animals were used. In a preliminary test, cows were given single doses of each species in amounts varying from .15 to .2 pound of dried material. Subsequently, two heifers weighing about 600 pounds were fed .2 pound daily for 14 consecutive days. Four calves averaging 354 pounds were fed .4 to 1.1 pounds of green fronds daily for feeding periods varying from 23 to 29 days. Except in one cow which developed a belligerent attitude uncharacteristic of her, no abnormalities were observed, even after the animals were driven as far as two miles.

The amounts fed may appear too small to give conclusive evidence of nontoxicity. Considering the availability of the plants and grazing habits of cattle, however, the amounts fed were thought to be greatly in excess of those likely to be taken in normal grazing.

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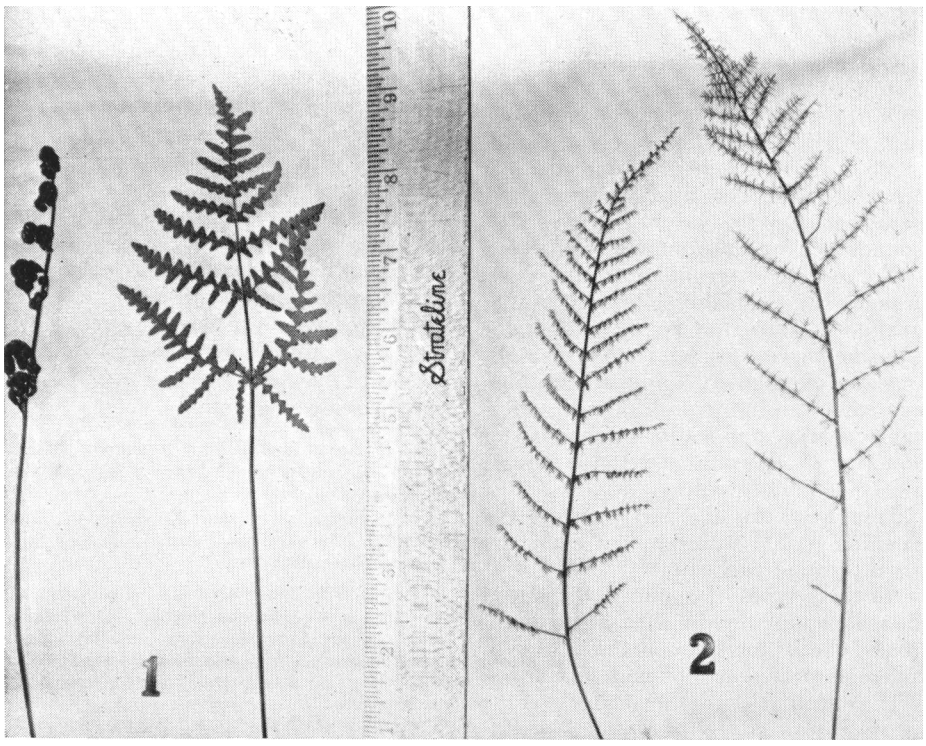
1. Gold fern (Gymnogramme triangularis). 2. Bird's foot fern (Pellaea ornithopus). In each case the desiccated form is to the left and the revived form to the right.

Photograph by Nathan Cohen



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means that of the total variability in blood-spot incidence between individuals about half is due to differences in their inheritance, the other half to environmental factors. The tendency toward blood-spotting is thus highly heritable.

To keep blood-spotting at a minimum in production-bred flocks, selection pressure against this defect must be maintained in breeding practice. In spite of its high heritability combined individual and family selection must be called upon in the choice of breeding stock. The lower the level of such a character as blood-spotting is in a flock the more difficult it is to obtain genetic gains in the desirable direction. Simple elimination of eggs carrying bood-spots from the incubators is not likely to produce great improvement when the incidence is not very high.

Similarly, if an otherwise good strain has a high level of blood-spotting, it is not likely that a simple outcross to another line will lower the incidence sufficiently to give a commercially tolerable level of inedible eggs. Under these conditions rigid selection in the original strain or continued selection of the outcross progeny would probably be required.

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