

## THE HARDINESS OF SOYBEAN SEED AS RELATED TO SEED COLOR

C. H. OATHOUT

*Western Illinois State Teachers' College, Macomb.*

The soybean (*Soja max*) is one of the oldest agricultural crops grown. It originated in Asia, and for centuries it has been one of the main agricultural crops in Manchuria, Korea, China, and Japan. In these countries it is used for human food, being considered too valuable to feed to livestock. There are more than 800 varieties, the seeds of which vary in size, shape, and color.

This crop was introduced into the United States in 1804, but it was almost a century before it was given much attention by experiment stations and farmers. Since the beginning of the present century, however, the increase in interest has been very marked.

The investigations reported in this brief paper were undertaken with a view to learning whether there are any differences in the characters of soybean seed, other than the visible ones, which are peculiar to the different varieties. The first simple test consisted in weighing into small wire baskets 200 grams of each of 13 common, representative varieties and exposing them to the changing humidity of the atmosphere but protecting them from rain and snow. These were weighed at frequent intervals during a period of 120 days in order to note the effect of humidity upon the hygroscopic moisture of the soybeans. Table I, summarizing these tests, shows, in general, that the yellow varieties were most sensitive to varying conditions of the atmosphere, the black varieties were least sensitive, while the brown varieties occupied an intermediate position in this respect. The Peking was an exception, behaving much like the yellow varieties.

### EFFECT OF TEMPERATURE AND AN EXCESS OF WATER UPON VIABILITY

As a further study of character differences 8 varieties, namely, Manchu, Midwest, Dunfield, Illinois 13-19, Virginia, Ebony, Wilson, and Peking were submerged in water with thermostats to maintain the temperature at 10°, 15°, 20°, and 30° C. At intervals of 24 hours samples were taken from each for germination. Table II summarizes the results as at the end of 35 days.

TABLE I—TOTAL VARIATION OF HYGROSCOPIC MOISTURE IN SOYBEANS EXPOSED TO VARYING ATMOSPHERIC HUMIDITY, GIVEN IN PERCENTAGE OF ORIGINAL WEIGHT.

Variety	Color	Variation
Manchu.....	Yellow	9.20%
Haberlandt.....	Yellow	6.55%
A K.....	Yellow	6.62%
Madwest.....	Yellow	7.56%
Dunfield.....	Yellow	8.44%
Elton.....	Yellow	8.42%
Ito San.....	Yellow	7.28%
Virginia.....	Brown	6.96%
Illinois 13-19.....	Brown	6.26%
Ebony.....	Black	5.82%
Wilson.....	Black	4.92%
Wisconsin Black.....	Black	4.22%
Peking.....	Black	7.22%

TABLE II—NUMBER OF DAYS DURING WHICH EIGHT VARIETIES OF SOYBEANS SUBMERGED IN WATER AND KEPT AT DIFFERENT TEMPERATURES CONTINUED TO SHOW VIABILITY.

Variety	Temperature				Color
	10°	15°	20°	30°	
Manchu.....	10	9	3	3	Yellow
Dunfield.....	12	5	5	1	Yellow
Midwest.....	12	7	3	3	Yellow
Peking.....	35	33	30	15	Black
Ebony.....	30	30	17	3	Black
Wilson.....	35	35	35	15	Black
Virginia.....	35	35	35	30	Brown
Illinois 13-19.....	35	35	34	7	Brown

The rapid decline in viability of the yellow-seeded varieties was very noticeable. In a short time the seed-coats slipped off and putrefaction took place. No impermeable seed-coats were apparent. The black-coated beans declined much less rapidly. They swelled and the coloring matter was dissolved out by the water, but no disintegration took place as in the yellow varieties. There was a small percentage of impermeable seed-coats. The same observations apply to the brown beans.

The higher temperatures had a distinctly more deleterious effect upon viability than did the lower. This was marked in the yellow and to a less extent in the black and brown varieties.

## FIELD TESTS

A. On November 24, 500 soybeans of each of the 13 varieties were sown on each of two plats 8 by 16 feet in size. On one of these wheat was drilled after the beans had been sown. On the other the beans were left uncovered through the winter and oats were sown on April 2 the following spring. Counts were made of the plants that came up on these two plats.

B. On November 29, 100 beans of each variety were planted in 16-foot rows at depths of 1, 2, 3, and 4 inches, respectively. In the spring counts were made of all the plants that came up in these rows.

C. On the same date 100 beans of each variety were buried 6 inches deep in a manner permitting their recovery and identification the next spring. On April 11 these were uncovered and counts made of the number that had sprouted. After counting, the beans were again covered with soil, but later investigation showed that no more had germinated.

The results of this field work are contained in Table III.

TABLE III—NUMBER OF PLANTS EMERGING IN THE SPRING FROM SEED PLANTED IN THE FALL.

Variety	Number of plants emerging in the spring					Number germinated	
	500 beans sown in fall with wheat	500 beans sown in fall; oats in spring	100 beans planted—depth				100 beans covered 6 inches in fall
			1"	2"	3"	4"	
<b>Yellow Varieties—</b>							
Elton.....	0	0	0	0	0	0	
Dunfield.....	0	0	0	0	0	0	
A K.....	0	0	0	0	1	0	
Manchu.....	0	0	0	1	0	0	
Midwest.....	0	1	0	0	2	1	
Ito San.....	0	3	0	0	0	2	
Haberlandt.....	3	2	0	0	0	1	
<b>Brown Varieties—</b>							
Illinois 13-19.....	11	5	3	5	10	15	
Virginia.....	1	1	0	1	4	6	
<b>Black Varieties—</b>							
Ebony.....	2	5	10	13	17	10	
Wisconsin Black.....	0	1	1	2	3	15	
Peking.....	24	9	7	13	22	10	
Wilson.....	20	17	18	16	18	33	

In all of these tests the brown and the black varieties withstood the unfavorable conditions much better and produced more plants than did the yellow beans.

D. In the fall, soybeans of the Manchu, the Ebony, the Wilson, and the Virginia varieties were left standing in the field in order to observe the effect of the winter upon their viability under these conditions. The results of germination tests made at two different dates in the winter are shown in Table IV.

TABLE IV—GERMINATION OF FOUR VARIETIES OF SOYBEANS LEFT IN THE FIELD DURING THE WINTER.

Variety	Color	Percentage of germination	
		December 20	February 26
Manchu.....	Yellow.....	37	3
Virginia.....	Brown.....	98	60
Ebony.....	Black.....	97	35
Wilson.....	Black.....	97	56

Table IV again brings out the greater hardiness of the black and the brown varieties. The differences in ability to withstand adverse conditions cannot be explained on the ground of impermeable seed-coats. The reasons for the differences would furnish an interesting subject for further investigation.