LARS Information Note 030468

A Crop Primer on CORN

Laboratory

for

Agricultural

Remote

Sensing

Purdue

University

Introduction[1/]

This information note is designed to further acquaint non-agriculturists with one of the major crops grown in Tippecanoe County, Indiana. An approach to acquaint one with the conditions of maturity at various times of the growing season is made also. Tippecanoe County is reasonably typical of much of the "Corn Belt" region of midwestern United States.

This primer is a composite of photographic prints and clippings from magazines, illustrating the appearance of corn at different stages of growth, as well as showing factors which affect growth and how these affect the general appearance of corn.

No attempt has been made to cover all factors. Many factors, such as disease, weeds, insects and so forth, will change, depending upon the specific locality, soil type or weather conditions under which the corn is growing. It should be noted that many different situations will cause corn to look different spectrally. It has been shown that corn will change "signatures" at different stages of growth since the plant structure, as well as the percentage of ground cover, will change throughout the growing season.

The total number of varieties of cultivated corn probably reaches the thousands. They differ in size, form, color, structure of grain, and in other respects. On the basis of structure of the grain, they can be classified into a few main groups: dent corn, flint corn, sweet corn, popcorn, pod corn, flour corn and waxy corn.

[1/] Prepared by C. Johannsen, Ground Truth Studies, Agricultural Research Programs, LARS. Author was assisted by D. Remsberg and J. Halsema in preparing this information note.

Dent corn is the most important group in the United States. This corn is called "dent" corn because of the characteristic "dent" or depression in the crown of the mature kernel caused by the presence of soft starch underneath. Outside of the United States, dent corn is considerably less important than flint corn. Flint corn is more commonly grown in South America and is lower yielding.

The 1964 acreage figures are the most current figures available. They are:

Tippecanoe County, Indiana	80,835 acres
Indiana	4,428,000 acres
United States	73,394,000 acres

The 1964 average yield figures are:

Tippecanoe County, Indiana	75.0 bu./acre
Indiana	94.0 bu./acre
United States	73.1 bu./acre

Stages

of

Growth

The different stages of growth of an annual crop such as corn are difficult to define. The crop may slowly change from day to day. An attempt is made to show corn at different ages (in weeks) throughout the growing season.

Statistical Reporting Service (SRS) uses a system of identifying the different stages of maturity based on the development of the ear. For purposes of clarifying this common terminology, we have attempted to use the SRS system to identify the various stages of maturity shown on the photos. There are some plant characteristics that accompany these various stages of maturity, but in general the different stages are based primarily upon the condition of the corn kernels, which must be examined physically to determine the specific stage of maturity.

The following is the system employed by SRS:

Maturity Stage	Description
No ears or silked ear shoots formed	
Pre-Blister	Shoot has some silks showing. Little or no watery, clear liquid present in "spikelets". When an ear has not reached the blister stage check "pre-blister".
Blister	Partially formed kernels well enlarged and full of watery, clear liquid. Most silks protruding from husks are beginning to turn color.
Milk	Plant or shuck green. Ears erect. No denting. Most kernels full of milk-like substance, but kernels not fully grown. Silks protruding from husks have turned brown and dry.
Dough	Shucks taking on a light rust colored appearance. Ears beginning to lean away from stalks. About one-half of kernels showing dent with some milk or dough-like substance in all kernels. Kernels fully grown.

Maturity Stage	Description
Dent	Shucks about dry but not beginning to open up. Foliage nearly all green. Ear firm and solid. Kernels fully dented but no milk present in most kernels. Crown of kernels still spongy and rather easily scratched or dented with thumbnail. Upon scratching, exposed starch has a mealy texture.
Mature	Shucks dry and beginning to open up. Very little green foliage present. Ears beginning to squeak upon twisting. Glossy or waxy appearance of kernels gone. Crown of kernels hard to scratch with the thumbnail.

On the following pages are photographs of corn at different growth stages. The corn on the cover is an example of corn in the milk stage at an age of 13 to 14 weeks. The pollen is almost gone and the tassels will turn a darker brown color as shown in the 15-week photograph.

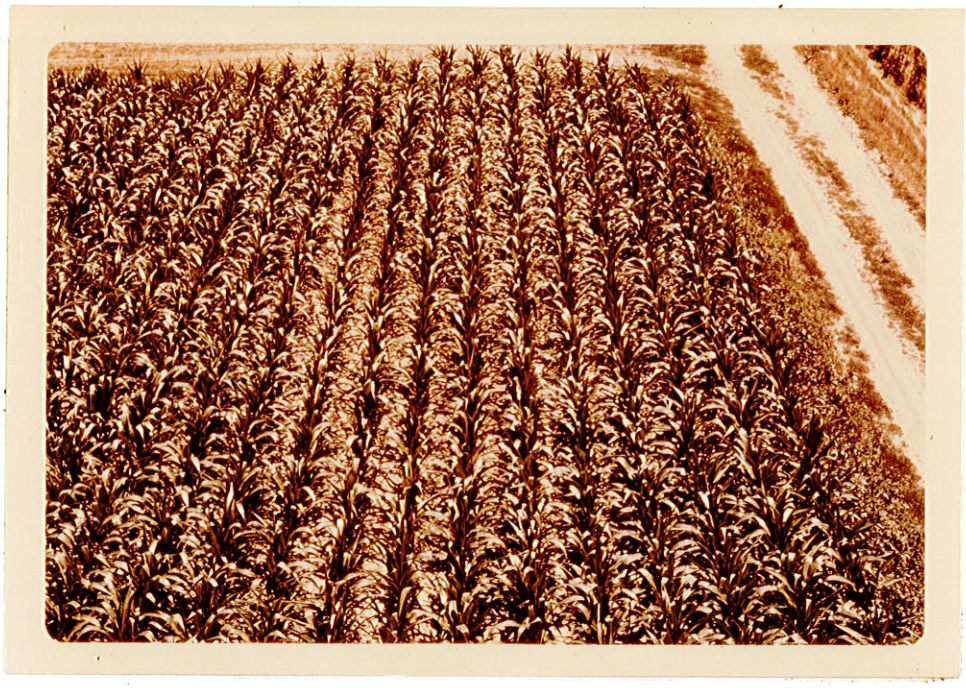
2 WEEKS

Both photographs were taken on June 5, 1966 of two different fields. At this stage of growth, the plants are covering less than 5% of the soil. The soil types in these two fields are very different, as evidenced by the color.

4 WEEKS

These plants are over two feet high and are covering about 25% of the ground surface when viewed from above. The field has been freshly cultivated, which will make this field appear darker in tone than an uncultivated field.

9 WEEKS



Corn viewed from 50 feet above the ground on July 25, 1966. This corn is over 5 feet tall. There is less ground cover than normal in this field since the corn is under drought stress and most of the leaves are rolled.

10 WEEKS

A close-up view of corn taken on August 5, 1966. These plants have received adequate moisture and have a good healthy green color.

13 WEEKS

This aerial view of a corn field shows a stripped pattern. The farmer planted four alternating rows of different varieties. The lighter toned strips are a variety which is tasseling while the darker toned strips are planted to a variety or varieties which have not tasseled.

15 WEEKS

A low-angle view of corn that is almost mature (photo taken on September 15, 1966). Ground cover is about 60% but appears higher due to the shadows of the corn. The tassels have turned a dark brown color and have shed all of their pollen. Earlier in the growing season, the tassels have a more yellow appearance due to the presence of the light yellow pollen. This corn would be in the blister stage of maturity, according to the SRS descriptions.

17 WEEKS

A mature field of corn that has been killed by frost. The frost will not decrease the yield at a late stage of growth. Yields are reduced by frost that arrives before September 15 in this area. Note how the per cent ground cover has been reduced due to dead leaves falling from the stalks. The tassels have also fallen, which is characteristic for this variety. Photo taken on September 30, 1966.

17+ WEEKS

Mature corn on the stalk. A typical ear will have 14 to 18 rows of kernels, depending on the variety. A typical one-pound ear of dent corn will have about 1,200 to 1,400 kernels.

Factors

Affecting

Growth

1. HEALTHY *stalk has normal size and cross-sectional color.*

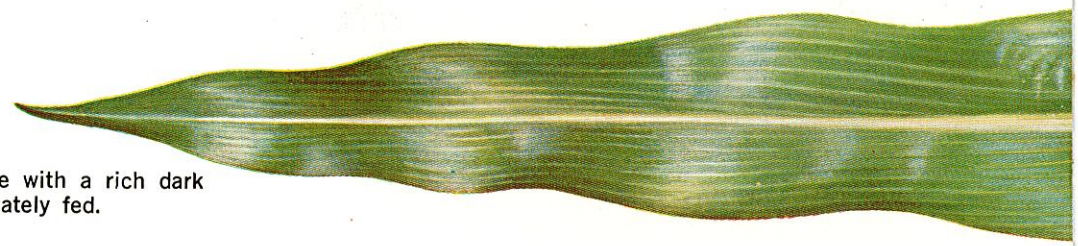
2. POTASH *is needed when slice-away reveals nodes discolored with darkish brown. Note contrast with normal cross section.*

3. PHOSPHATE *controls stalk size and ear set; when there's a shortage, stalks are weak, spindly and often barren of ears.*

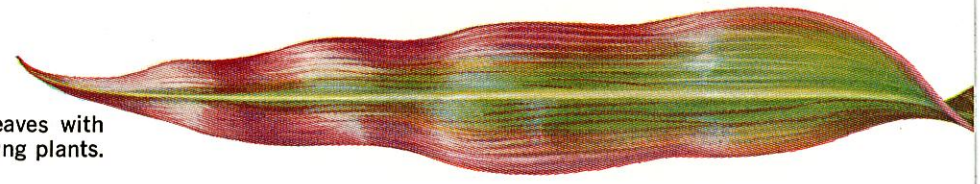
4. SUCKERS *spring from certain hybrids when corn gets too much nitrogen early in growth. Later, corn feeds on nitrogen voraciously. Slice-away shows corn-borer damage.*

5. DISEASES *found in stalks include black bundle in the upper slice-away and the darker stalk rot below. Stalk rot hollows the interior, causing early drying and breakage.*

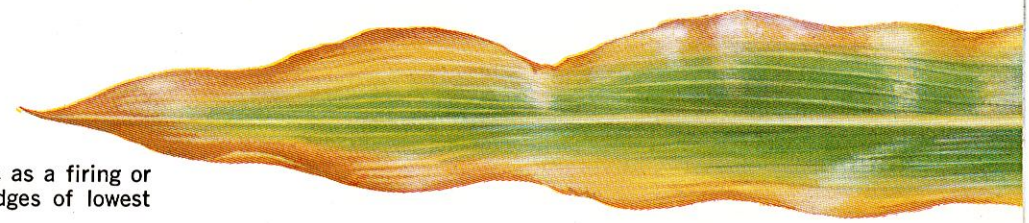
Deficiency Symptoms of Plants



HEALTHY leaves shine with a rich dark green color when adequately fed.

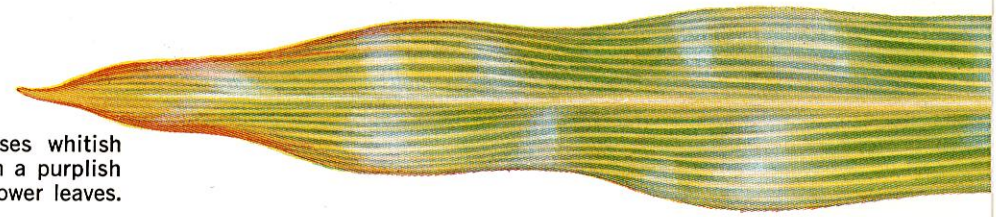


PHOSPHATE shortage marks leaves with reddish-purple, particularly on young plants.



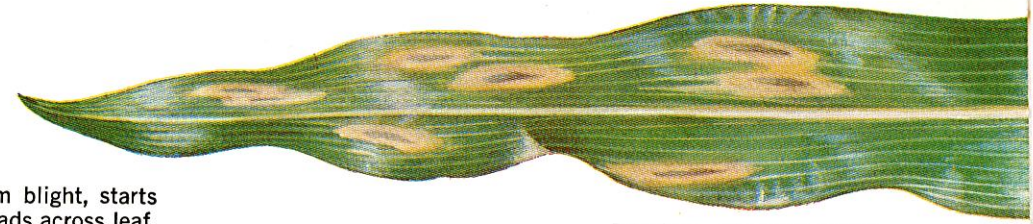
POTASH deficiency appears as a firing or drying along the tips and edges of lowest leaves.

NITROGEN hunger sign is yellowing that starts at tip and moves along middle of leaf.



MAGNESIUM deficiency causes whitish strips along the veins and often a purplish color on the undersides of the lower leaves.

DROUGHT causes the corn to have a grayish-green color and the leaves to roll up nearly to the size of a pencil.



DISEASE, helminthosporium blight, starts in small spots, gradually spreads across leaf.

Drawings: Maynard Reece

DEFICIENCY SYMPTOMS OF LEAVES

FLOODING

This farmer was unable to harvest this corn in the fall due to unusually wet weather. During the winter, heavy rains fell on the saturated soils and flooding resulted. This field of over 50 acres plus many others were lost. Photo taken on February 1, 1968.

PONDING

Heavy spring rains will frequently cause "ponds" of water to form in the low areas in crop fields. If the soil is completely saturated, the standing water will cause death to the crop due to lack of oxygen. Low areas in many northern Indiana fields will be bare or will have weeds grown in them due to the ponding effect.

WEEDS

This is a good example of what a field of corn will look like in a very wet spring. The farmer was unable to get into the field to cultivate for weed control. Note that the rows of corn in the uncultivated areas are barely distinguishable. The low-lying area in the foreground was completely barren of weeds and corn due to the ponding effect.

WEEDS

A close-up of weeds in a corn field. Chemicals are now available which will control these weeds but they can be expensive if not used properly. In order to be meaningful, an estimate of per cent ground cover should include that of the weeds as well as corn.

(or time to mature)

Length of growing season varies greatly.

In central Indiana 4-5 months

In Andes near Equator 11-13 months

In Alabama 5-6 months

In many corn growing areas (esp. in Latin America) crop is not planted in rows, but in hills -- may or may not follow row pattern.

with a fish in each hill!

T. L. Phillips

Page 2. What % of U.S. corn is Dent Corn?

The first paragraph is somewhat misleading or confusing and doesn't lead into the 2nd paragraph.

Page 5 and 11

Corn at 13-14 weeks is at milk stage and Corn at 15 weeks is at Blister stage?

Need pictures of corn at Dough stage and dent stage

What are preplanting and planting characteristics of corn fields?

We could increase the information in this Note to include some spectral responses to the deficiencies shown.

p. 7 Date (for 25% cover)

p. 11 Dent stage? Impossible to go from blister stage at 15 weeks to mature stage at 17 weeks. Also, if photo was taken on Sept 15, it must be in dent stage.

p. 13 "Mature corn on the stalk with the shuck pulled back to expose the corn kernels.

p. 18 l. 4 last word "growing" instead of grown

p. 20 For remote sensing research, estimates of per cent ground cover ——————— in order to be meaningful.

Include a corn (& perhaps other crops) maturity chart