

OBJECTIVE DESCRIPTION OF VARIETY

Corn (*Zea mays* L.)

INSTRUCTIONS

Please read instructions carefully before completing the attached form. The Objective Description Form is a necessary part of an application for Plant Variety Protection (Breeder's Rights) in the United States of America. It is designed to guide the applicant in describing a corn inbred variety in detail so that comparisons with other corn inbred varieties may be done in a meaningful way. To aid in this goal, data collectors and breeders from different locations should collect the data in a similar fashion. These instructions describe the way in which to take each measurement needed to complete this form. It is possible that some traits are unobtainable for a certain type of corn, causing some blanks to be left empty. It is in your best interest to describe your inbred variety as completely as possible to establish an adequate variety description.

The applicant's name and complete address should be at the top of the form. The country should be included since it is needed when mailing to some areas. The name of the inbred variety is also entered at the top of the form. The Plant Variety Protection Office will assign a unique PVPO Number to each application and enter it below the inbred variety name.

Lists of color choices and standard inbred choices are given at the top of the form. The color choices are to be used, along with the "Munsell Color Chart for Plant Tissues" color codes, when describing a color trait of the inbred variety. Choose ONE of the standard inbreds to use for comparison with your inbred variety throughout the Objective Description Form. The standard inbred that you choose should be the most similar one in terms of background and maturity. It does not need to be the same one used in the Exhibit B to describe the novelty of the application variety. The comparison inbred variety used to describe novelty and the standard inbred variety should be grown in field trials **with** the application variety for 2-3 location/years (environments) **in the region of best adaptability**. Samples of the listed inbreds can be obtained from the North Central Regional Plant Introduction Station in Ames, Iowa. The varietal and environmental data collected should remain available for an additional 3 years to resolve any questions concerning comparisons or descriptions of inbred varieties. In general, measurements of quantitative traits should be taken on 15-25 randomly selected plants or plant parts to obtain averages and statistics that describe a typical field of the inbred variety.

1. TYPE

- Name the standard inbred to be used for comparisons. **Describe the standard variety in the right-hand column for all traits on form.**
- Choose the kernel type that best describes your variety. If it is a combination of two types (e.g. flinty dent), or a type not listed on the form

2. REGION WHERE BEST ADAPTED IN THE U.S.A.

- Choose one region where the inbred variety is expected to grow best. Indicate where the data to complete this form were collected in the Comments section of the form.
- Indicate the seed source of the standard inbred, including lot number or row number, which has been certified for use in PVP applications.

3. MATURITY

- Although heat units, or growing degree units, are considered to be more accurate than days to maturity, BOTH values may be necessary to differentiate your variety from all other varieties in the database. **Show the formula used to calculate "heat units" in the Comments section of the form.**

4. PLANT

For each of the measurable traits, **report the number of plants measured and the standard deviation.**

$$\text{StandardDeviation} = \sqrt{\frac{\sum(X - \bar{X})^2}{(N - 1)}}$$

- Measure plant height from ground level to tip of tassel.
- Measure ear height from ground level to the base of the node from which the top ear develops.
- Measure length of internode located between the top ear node and the node above it.
- Measure the average number of tillers per plant.
- Measure the average number of ears per stalk.
- Report the presence or absence of anthocyanin in the brace roots.

5. LEAF

For each of the measurable traits, **report the number of plants measured and the standard deviation.**

- Measure the width of the leaf at the top ear node at its widest point.
- Measure the length of the leaf at the top ear node.
- Count the number of leaves above the top ear node.
- Report the adaxial angle between the stalk and the second leaf above the ear at anthesis.
- Report the color of the second leaf above the ear at anthesis. Color codes are listed on page 1. List the Munsell color code also.
- Rate leaf sheath pubescence at the second leaf above the ear at anthesis on a scale from 1 (none) to 9 (like peach fuzz).
- Rate the presence of marginal waves on a scale from 1 (none) to 9 (many). Determine this rating by observing the leaf sides in relation to the leaf's central axis.
- Rate the presence of creases that run parallel to the veins on the leaf blade on a scale from 1 (none) to 9 (many).

6. TASSEL

For each of the measurable traits, **report the number of plants measured and the standard deviation.**

- Count the number of lateral tassel branches that originate from the central spike only.
- Report the adaxial angle between the central spike and the primary lateral tassel branch from the top at anthesis.
- Report the length of the tassel from the top leaf collar to the tassel tip.
- Rate the amount of pollen shed on a scale of 0 (male sterile) to 9 (heavy shed).
- Report the color of the anthers and the glumes. Evaluate the colors in the fresh stage after exposure to the sun to allow for pigment development. Color codes are on Page 1. List the Munsell color code also.
- Report whether the glumes have colored bars perpendicular to their veins.

CORN (*Zea mays* L.)
INSTRUCTIONS (CONTINUED)

7a. EAR

Judge the following characteristics on an unhusked ear.

- Report the color of the silks at the silking stage. Evaluate the color in the fresh stage after exposure to the sun to allow for pigment development. Color codes are on Page 1. List the Munsell color code also.
- Report the fresh husk color as it appears 25 days after 50% silking.
- Report the dry husk color as it appears 65 days after 50% silking.
- Report the position of the ear 65 days after 50% silking.
- Report the tightness of the husk 65 days after 50% silking on a scale from 1 (very loose) to 9 (very tight).
- Report how far the husk extends past the end of the ear at harvest time.

7b. EAR

Judge the following characteristics on a DRY (at least 12-13% grain moisture), husked ear. For each of the measurable traits, **report the number of plants measured and the standard deviation.**

- Measure the length of the ear from butt to tip.
- Measure the diameter of the ear at the mid-point of its length.
- Measure the weight of the husked ear. This should be at the seed stage, not the edible stage.
- Report the average number of rows of kernels on the ear. If rows are indistinct, report the average number of kernels located along the circumference of the ear at the mid-point of its length.
- Report whether kernels are in identifiable rows or not.
- Report how rows of kernels are aligned from butt to tip.
- Measure the length of the ear shank from the butt of the ear to the ear node on the stalk.
- Report the amount of taper to the ear.

8. KERNEL

Judge the following characteristics on DRY (at least 12-13% grain moisture) kernels. For each of the measurable traits, **report the number of plants measured and the standard deviation.**

- Measure the length of kernels
- Measure the width of kernels.
- Measure the thickness of kernels.
- Measure the percent of round kernels in an unsized sample using a 13/64 inch slot screen.
- This characteristic is most important in describing ornamental corns and some popcorns. The aleurone is a very thin layer of cells located between the pericarp and the hard endosperm. Scrape away the skin-like pericarp to expose the aleurone, which will remain attached to either the inside of the pericarp or the outside of the hard endosperm. Report the color pattern and the color of the aleurone. Color codes are on Page 1. List the Munsell color code also. Describe, if necessary, in the Comments section or in the Exhibit D.
- Scrape away the pericarp and aleurone to expose the hard endosperm. Report the color of the hard endosperm. Color codes are on Page 1. List the Munsell color code also. Describe, if necessary, in the Comments section or in Exhibit D.
- Report the endosperm type.
- Measure the weight of 100 kernels taken from an unsized sample.

9. COB

- Measure the diameter of the cob at the mid-point of its length. Report the number of plants measured and the standard deviation.
- Report the color of the cob. Color codes are on Page 1. List the Munsell color code also.

10. DISEASE REACTION

11. INSECT REACTION

- Test as many disease and insect reactions as possible BEFORE applying for protection. BEST: Test reactions for at least the 5 most common diseases or insects for the region in which the inbred variety is best adapted. Many older inbred varieties were tested extensively for disease and insect reactions. More complete information in these sections of the application may speed the determination of distinctness.
- Rate the application variety and the standard inbred variety on a scale of 1 (most susceptible) to 9 (most resistant) for each disease or insect reaction being reported.

12. AGRONOMIC TRAITS

- Rate the stay green ability of the inbred variety as it appears 65 days after anthesis. The rating scale is from 1 (worst stay green; early die-back) to 9 (best stay green: late die-back)
- Report the percent of dropped ears at 65 days after anthesis.
- Report the percent of brittle snapping before anthesis.
- Report the percent of root lodging before anthesis.
- Report the percent of root lodging at 65 days after anthesis.
- Report the dry (at 12-13% grain moisture) corn yield of the inbred per se. Do not use this to establish novelty of an inbred line.

13. MOLECULAR MARKERS

- Report whether molecular marker data are available. Applicants are encouraged to obtain and submit molecular marker data to facilitate variety description. Isozyme data will be added to the computer description of the inbred variety, in preparation for future use of this data in distinguishing between inbred varieties. (The database is not yet capable of distinguishing two inbred varieties solely on the basis of molecular information, so morphological descriptors will continue to be necessary for all applications.) Other molecular marker data submitted with an application will be included in the official description of the inbred variety stored in the Plant Variety Protection Office archives.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 3.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

**U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705**

Exhibit C

**OBJECTIVE DESCRIPTION OF VARIETY
Corn (*Zea mays* L.)**

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
ADDRESS (Street and No. or RD No., City, State, Zip Code, and Country)		FOR OFFICIAL USE ONLY
		PVPO NUMBER

Place the appropriate number that describes the varietal characters typical of this inbred variety in the spaces below. Right justify whole numbers by adding leading zeroes if necessary. Completeness should be striven for to establish an adequate variety description.

COLOR CHOICES (Use in conjunction with Munsell color code to describe all color choices: describe #25 and #26 in Comments section):

- | | | | | |
|----------------------|--------------------|------------------|-------------------|----------------------------|
| 01 = Light Green | 06 = Pale Yellow | 11 = Pink | 16 = Pale Purple | 21 = Buff |
| 02 = Medium Green | 07 = Yellow | 12 = Light Red | 17 = Purple | 22 = Tan |
| 03 = Dark Green | 08 = Yellow-Orange | 13 = Cherry Red | 18 = Colorless | 23 = Brown |
| 04 = Very Dark Green | 09 = Salmon | 14 = Red | 19 = White | 24 = Bronze |
| 05 = Green-Yellow | 10 = Pink-Orange | 15 = Red & White | 20 = White Capped | 25 = Variegated (Describe) |
| | | | | 26 = Other (Describe) |

STANDARD INBRED CHOICES (Use the **most similar** (in background and maturity) of these to make comparisons based on **grow-out trial data**):

- | | | |
|---|--|--|
| Yellow Dent Families:
Family Members
B14 CM105, A632, B64, B68
B37 B37, B76, H84
B73 N192, A679, B73, NC268
C103 Mo17, Va102, Va35, A682
Oh43 A619, MS71, H99, Va26
WF9 W64A, A554, A654, Pa91 | Yellow Dent (Unrelated):
Co109, ND246
Oh7, T232
W117, W153R
W182BN | Sweet Corn:
C13, Iowa5125, P39, 2132

Popcorn:
SG1533, 4722, HP301, HP7211

Pipecorn:
Mo15W, Mo16W, Mo24W |
| White Dent:
CI66, H105, Ky228 | | |

<p>1. TYPE: (Describe intermediate types in Comments section)</p> <p>_____ 1 = Sweet 2 = Dent 3 = Flint 4 = Flour 5 = Pop 6 = Ornamental 7 = Pipecorn 8 = Other</p>	<p>Standard Inbred Name: _____</p> <p>_____ Type</p>
<p>2. REGION WHERE DEVELOPED IN THE U.S.A.:</p> <p>_____ 1 = Northwest 2 = North central 3 = Northeast 4 = Southeast 5 = South central 6 = Southwest 7 = Other _____</p>	<p>Standard Seed Source: _____</p> <p>_____ Region</p>
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Note: Use chart on first page to choose color codes for color traits.

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<p>7a. EAR (Unhusked Data):</p> <p>___ Silk Color (3 days after emergence) (Munsell code _____)</p> <p>___ Fresh Husk Color (25 days after 50% silking) (Munsell code _____)</p> <p>___ Dry Husk Color (65 days after 50% silking) (Munsell code _____)</p> <p>___ Position of Ear at Dry Husk Stage: 1 = Upright 2 = Horizontal 3 = Pendent</p> <p>___ Husk Tightness (Rate on scale from 1 = very loose to 9 = very tight)</p> <p>___ Husk Extension (at harvest): 1 = Short (ears exposed) 2 = Medium (<8 cm) 3 = Long (8-10 cm beyond ear tip) 4 = Very Long (>10 cm)</p>	<p>___ (Munsell Code _____)</p> <p>___ (Munsell Code _____)</p> <p>___ (Munsell Code _____)</p> <p>___</p> <p>___</p> <p>___</p>																																																												
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Application Variety Data

Standard Inbred Data

Note: Use chart on first page to choose color codes for color traits.

Application Variety Data	Standard Inbred Data
<p>10. DISEASE RESISTANCE (Rate from 1 (most susceptible) to 9 (most resistant); leave blank if not tested; leave Race or Strain Options blank if polygenic):</p>	
<p>A. Leaf Blights, Wilts, and Local Infection Diseases</p>	
<p><input type="checkbox"/> Anthracnose Leaf Blight (<i>Colletotrichum graminicola</i>)</p> <p><input type="checkbox"/> Common Rust (<i>Puccinia sorghi</i>)</p> <p><input type="checkbox"/> Common Smut (<i>Ustilago maydis</i>)</p> <p><input type="checkbox"/> Eyespot (<i>Kabatiella zeae</i>)</p> <p><input type="checkbox"/> Goss's Wilt (<i>Clavibacter michiganense</i> spp. <i>nebraskense</i>)</p> <p><input type="checkbox"/> Gray Leaf Spot (<i>Cercospora zeae-maydis</i>)</p> <p><input type="checkbox"/> Helminthosporium Leaf Spot (<i>Bipolaris zeicola</i>) Race _____</p> <p><input type="checkbox"/> Northern Leaf Blight (<i>Exserohilum turcicum</i>) Race _____</p> <p><input type="checkbox"/> Southern Leaf Blight (<i>Bipolaris maydis</i>) Race _____</p> <p><input type="checkbox"/> Southern Rust (<i>Puccinia polysora</i>)</p> <p><input type="checkbox"/> Stewart's Wilt (<i>Erwinia stewartii</i>)</p> <p><input type="checkbox"/> Other (Specify) _____</p>	<p><input type="checkbox"/> Anthracnose Leaf Blight</p> <p><input type="checkbox"/> Common Rust</p> <p><input type="checkbox"/> Common Smut</p> <p><input type="checkbox"/> Eyespot</p> <p><input type="checkbox"/> Goss's Wilt</p> <p><input type="checkbox"/> Gray Leaf Spot</p> <p><input type="checkbox"/> Helminthosporium Leaf Spot Race _____</p> <p><input type="checkbox"/> Northern Leaf Blight Race _____</p> <p><input type="checkbox"/> Southern Leaf Blight Race _____</p> <p><input type="checkbox"/> Southern Rust</p> <p><input type="checkbox"/> Stewart's Wilt</p> <p><input type="checkbox"/> Other (Specify) _____</p>
<p>B. Systemic Diseases</p>	
<p><input type="checkbox"/> Corn Lethal Necrosis (MCMV and MDMV)</p> <p><input type="checkbox"/> Head Smut (<i>Sphacelotheca reiliana</i>)</p> <p><input type="checkbox"/> Maize Chlorotic Dwarf Virus (MCDV)</p> <p><input type="checkbox"/> Maize Chlorotic Mottle Virus (MCMV)</p> <p><input type="checkbox"/> Maize Dwarf Mosaic Virus (MDMV) Strain _____</p> <p><input type="checkbox"/> Sorghum Downy Mildew of Corn (<i>Peronosclerospora sorghi</i>)</p> <p><input type="checkbox"/> Other (Specify) _____</p>	<p><input type="checkbox"/> Corn Lethal Necrosis</p> <p><input type="checkbox"/> Head Smut</p> <p><input type="checkbox"/> Maize Chlorotic Dwarf Virus</p> <p><input type="checkbox"/> Maize Chlorotic Mottle Virus</p> <p><input type="checkbox"/> Maize Dwarf Mosaic Virus Strain _____</p> <p><input type="checkbox"/> Sorghum Downy Mildew of Corn</p> <p><input type="checkbox"/> Other (Specify) _____</p>
<p>C. Stalk Rots</p>	
<p><input type="checkbox"/> Anthracnose Stalk Rot (<i>Colletotrichum graminicola</i>)</p> <p><input type="checkbox"/> Diplodia Stalk Rot (<i>Stenocarpella maydis</i>)</p> <p><input type="checkbox"/> Fusarium Stalk Rot (<i>Fusarium moniliforme</i>)</p> <p><input type="checkbox"/> Gibberella Stalk Rot (<i>Gibberella zeae</i>)</p> <p><input type="checkbox"/> Other (Specify) _____</p>	<p><input type="checkbox"/> Anthracnose Stalk Rot</p> <p><input type="checkbox"/> Diplodia Stalk Rot</p> <p><input type="checkbox"/> Fusarium Stalk Rot</p> <p><input type="checkbox"/> Gibberella Stalk Rot</p> <p><input type="checkbox"/> Other (Specify) _____</p>
<p>D. Ear and Kernel Rots</p>	
<p><input type="checkbox"/> Aspergillus Ear and Kernel Rot (<i>Aspergillus flavus</i>)</p> <p><input type="checkbox"/> Diplodia Ear Rot (<i>Stenocarpella maydis</i>)</p> <p><input type="checkbox"/> Fusarium Ear and Kernel Rot (<i>Fusarium moniliforme</i>)</p> <p><input type="checkbox"/> Gibberella Ear Rot (<i>Gibberella zeae</i>)</p> <p><input type="checkbox"/> Other (Specify) _____</p>	<p><input type="checkbox"/> Aspergillus Ear and Kernel Rot</p> <p><input type="checkbox"/> Diplodia Ear Rot</p> <p><input type="checkbox"/> Fusarium Ear and Kernel Rot</p> <p><input type="checkbox"/> Gibberella Ear Rot</p> <p><input type="checkbox"/> Other (Specify) _____</p>

<p>11. INSECT RESISTANCE (Rate from 1 (most susceptible) to 9 (most resistant) Leave blank if not tested):</p>	
Standard Deviation Sample Size	Mean Standard Deviation Sample Size
<p><input type="checkbox"/> Banks Grass Mite (<i>Oligonychus pratensis</i>)</p>	<p><input type="checkbox"/> Banks Grass Mite</p>
<p>Corn Earworm (<i>Helicoverpa zea</i>)</p>	
<p><input type="checkbox"/> Leaf-Feeding</p> <p><input type="checkbox"/> Silk Feeding: _____. ____ mg larval wt. _____</p> <p><input type="checkbox"/> Ear Damage</p>	<p><input type="checkbox"/> Leaf-Feeding</p> <p><input type="checkbox"/> Silk Feeding: _____. ____ mg larval wt. _____</p> <p><input type="checkbox"/> Ear Damage</p>
<p><input type="checkbox"/> Corn Leaf Aphid (<i>Rhopalosiphum maidis</i>)</p> <p><input type="checkbox"/> Corn Sap Beetle (<i>Carpophilus dimidiatus</i>)</p>	
<p>European Corn Borer (<i>Ostrinia nubilalis</i>)</p>	
<p><input type="checkbox"/> 1st Generation (Typically Whorl Leaf Feeding)</p> <p><input type="checkbox"/> 2nd Generation (Typically Leaf Sheath-Collar Feeding)</p> <p>Stalk Tunneling:</p> <p>_____. ____ cm tunneled/plant _____</p>	<p><input type="checkbox"/> 1st Generation</p> <p><input type="checkbox"/> 2nd Generation</p> <p>Stalk Tunneling:</p> <p>_____. ____ cm tunneled/plant _____</p>
<p>Fall Armyworm (<i>Spodoptera frugiperda</i>)</p>	
<p><input type="checkbox"/> Leaf-Feeding</p> <p><input type="checkbox"/> Silk Feeding:</p> <p>_____. ____ mg larval wt. _____</p>	<p><input type="checkbox"/> Leaf-Feeding</p> <p><input type="checkbox"/> Silk Feeding:</p> <p>_____. ____ mg larval wt. _____</p>

Application Variety Data

Standard Inbred Data

