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- [54] **INBRED CORN LINE PHV37**
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47/58; 435/240.4, 240.49, 240.5

[56] References Cited

U.S. PATENT DOCUMENTS

4,812,600 3/1989 Jensen 800/1

OTHER PUBLICATIONS

- Duncan, et al (1985) Production of Callus Capable of Plant Regeneration from Immature Embryos of Numerous *Zea Mays* Genotypes, *Planta* 165:322-332.
 Songstad (1988) Effect of ACC (1-aminocyclopropane-1-carboxylic acid), Silver Nitrate, and Norbornadiene on Plant Regeneration from Maize Callus Cultures, *Plant Cell Reports* 7:262-265.
 Rao, et al (1986) Somatic Embryogenesis in Glume Callus Cultures Maize Genetics Cooperation Newsletter 60:64-65.
 Congar, et al (1987) Somatic Embryogenesis from Cultured Leaf Segments of *Zea mays*, *Plant Cell Reports* 6:345-347.

- Poehlman (1987) In Breeding Field Crops, pp. 237-246, AOI Publishing Co. Westport CT.
 Bates (1974) Dept. Grain Sci Konas Stete Molecular. USA Londus Mexico, Cimmyt (Abst related on).
 Mowacki et al. (1972) Bull de L'Acad. Blonaisedes Sci ool xx #10, pp. 695-698.
 Sprogue et al. (1977) In/Com & Corn Improvement, Ed. by G. F. Sprogue, ASA Publication, Madison WI 1 and 35.
 Galinat (1977) In/Corn & Corn Improvement, Ed. by G. F. Sprague, ASA Inc. Publication Madison WI, pp. 1 and 35.
 Green et al. (1982) In/Maize for Biol. Res. Ed W. Sherdon, pp. 367-372, Pl. Mol. Biol. Assoc. Dedota U Press M.
 Germplasm Presouces Information Het. (1954), *Zea Mays* PI. 2137 82.
 Poehhman (1987), Breeding Field Crops, pp. 38-41, AUI Publishing Company Inc. Westport CT.

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[57]

ABSTRACT

According to the invention, there is provided an inbred corn line, designated PHV37. This invention thus relates to the plants and seeds of inbred corn line PHV37 and to methods for producing a corn plant produced by crossing the inbred line PHV37 with itself or with another corn plant. This invention further relates to hybrid corn seeds and plants produced by crossing the inbred line PHV37 with another corn line or plant and to crosses with related species.

5 Claims, No Drawings

INBRED CORN LINE PHV37

FIELD OF THE INVENTION

This invention is in the field of corn breeding, specifically relating to an inbred corn line designated PHV37.

BACKGROUND OF THE INVENTION

The goal of plant breeding is to combine in a single variety/hybrid various desirable traits. For field crops, these traits may include resistance to diseases and insects, tolerance to heat and drought, reducing the time to crop maturity, greater yield, and better agronomic quality. With mechanical harvesting of many crops, uniformity of plant characteristics such as germination and stand establishment, growth rate, maturity, and fruit size, is important.

Field crops are bred through techniques that take advantage of the plant's method of pollination. A plant is self-pollinated if pollen from one flower is transferred to the same or another flower of the same plant. A plant is cross-pollinated if the pollen comes from a flower on a different plant.

Plants that have been self-pollinated and selected for type for many generations become homozygous at almost all gene loci and produce a uniform population of true breeding progeny. A cross between two homozygous lines produce a uniform population of hybrid plants that may be heterozygous for many gene loci. A cross of two plants each heterozygous at a number of gene loci will produce a population of hybrid plants that differ genetically and will not be uniform.

Corn plants (*Zea mays L.*) can be bred by both self-pollination and cross-pollination techniques. Corn has separate male and female flowers on the same plant, located on the tassel and the ear, respectively. Natural pollination occurs in corn when wind blows pollen from the tassels to the silks that protrude from the tops of the incipient ears.

The development of corn hybrids requires the development of homozygous inbred lines, the crossing of these lines, and the evaluation of the crosses. Pedigree breeding and recurrent selection breeding methods are used to develop inbred lines from breeding populations. Breeding programs combine the genetic backgrounds from two or more inbred lines or various other broad-based sources into breeding pools from which new inbred lines are developed by selfing and selection of desired phenotypes. The new inbreds are crossed with other inbred lines and the hybrids from these crosses are evaluated to determine which of those have commercial potential.

Pedigree breeding for single-gene traits starts with the crossing of two genotypes, each of which may have one or more desirable characteristics that is lacking in the other or which complement the other. If the two original parents do not provide all of the desired characteristics, other sources can be included in the breeding population. In the pedigree method, superior plants are selfed and selected in successive generations. In the succeeding generations the heterozygous condition gives way to homogeneous lines as a result of self-pollination and selection. Typically in the pedigree method of breeding five or more generations of selfing and selection is practiced: $F_1 \rightarrow F_2; F_2 \rightarrow F_3; F_3 \rightarrow F_4; F_4 \rightarrow F_5$, etc.

Backcrossing can be used to improve an inbred line. Backcrossing transfers a specific desirable trait from

one inbred or source to an inbred that lacks that trait. This can be accomplished for example by first crossing a superior inbred (A) (recurrent parent) to a donor inbred (non-recurrent parent), which carries the appropriate gene(s) for the trait in question. The progeny of this cross is then mated back to the superior recurrent parent (A) followed by selection in the resultant progeny for the desired trait to be transferred from the non-recurrent parent. After five or more backcross generations with selection for the desired trait, the progeny will be heterozygous for loci controlling the characteristic being transferred, but will be like the superior parent for most or almost all other genes. The last backcross generation would be selfed to give pure breeding progeny for the gene(s) being transferred.

A single cross hybrid corn variety is the cross of two inbred lines, each of which has a genotype which complements the genotype of the other. The hybrid progeny of the first generation is designated F_1 . In the development of hybrids only the F_1 hybrid plants are sought. Preferred F_1 hybrids are more vigorous than their inbred parents. This hybrid vigor, or heterosis, can be manifested in many polygenic traits, including increased vegetative growth and increased yield.

The development of a hybrid corn variety involves three steps: (1) the selection of plants from various germplasm pools; (2) the selfing of the selected plants for several generations to produce a series of inbred lines, which, although different from each other, each breed true and are highly uniform; and (3) crossing the selected inbred lines with unrelated inbred lines to produce the hybrid progeny (F_1). During the inbreeding process in corn, the vigor of the lines decreases. Vigor is restored when two unrelated inbred lines are crossed to produce the hybrid progeny (F_1). An important consequence of the homozygosity and homogeneity of the inbred lines is that the hybrid between any two inbreds will always be the same. Once the inbreds that give a superior hybrid have been identified, the hybrid seed can be reproduced indefinitely as long as the homogeneity of the inbred parents is maintained.

A single cross hybrid is produced when two inbred lines are crossed to produce the F_1 progeny. A double cross hybrid is produced from four inbred lines crossed in pairs ($A \times B$ and $C \times D$) and then the two F_1 hybrids are crossed again ($(A \times B) \times (C \times D)$). Much of the hybrid vigor exhibited by F_1 hybrids is lost in the next generation (F_2). Consequently, seed from hybrid varieties is not used for planting stock.

Corn is an important and valuable field crop. Thus, a continuing goal of plant breeders is to develop high-yielding corn hybrids that are agronomically sound based on stable inbred lines. The reasons for this goal are obvious: to maximize the amount of grain produced with the inputs used and minimize susceptibility to environmental stresses. To accomplish this goal, the corn breeder must select and develop superior inbred parental lines for producing hybrids. This requires identification and selection of genetically unique individuals which in a segregating population occur as the result of a combination of crossover events plus the independent assortment of specific combinations of alleles at many gene loci which results in specific genotypes. Based on the number of segregating genes, the frequency of occurrence of an individual with a specific genotype is less than 1 in 10,000. Thus, even if the entire genotype of the parents has been characterized and the desired geno-

type is known, only a few if any individuals having the desired genotype may be found in a large F₂ or S₀ population. Typically, however, the genotype of neither the parents nor the desired genotype is known in any detail.

SUMMARY OF THE INVENTION

According to the invention, there is provided a novel inbred corn line, designated PHV37. This invention thus relates to the seeds of inbred corn line PHV37, to the plants of inbred corn line PHV37, and to methods for producing a corn plant produced by crossing the inbred line PHV37 with itself or another corn line. This invention further relates to hybrid corn seeds and plants produced by crossing the inbred line PHV37 with another corn line or a related species.

DEFINITIONS

In the description and examples that follow, a number of terms are used herein. In order to provide a clear and consistent understanding of the specification and claims, including the scope to be given such terms, the following definitions are provided:

BAR PLT=BARREN PLANTS. This is the number of plants per plot that were not barren (lack ears).

BRT STK=BRITTLE STALKS. This is a measure of the stalk breakage near the time of pollination, and is an indication of whether a hybrid or inbred would snap or break near the time of flowering under severe winds. Data are presented as percentage of plants that did not snap.

BU ACR=YIELD (BUSHEL/ACRE). Actual yield of the grain at harvest adjusted to 15.5% moisture. **ABS** is in absolute terms and **% MN** is percent of the mean for the experiments in which the inbred or hybrid was grown.

CLD TST=COLD TEST. This is the percentage of kernels that germinate under cold soil conditions. **ABS**=absolute measurement and **% MN** is percentage of mean of the experiments in which inbred or hybrid was grown.

COB SC=COB SCORE. The cob score is a rating of how well the grain is shelled off the cob and how badly the cob is broken up going through the combine. This is given as a 1 to 9 score with 9 being very good. A high score indicates that the grain shells off the cob well, and the cob does not break.

DRP EAR=DROPPED EARS. This is a measure of the number of dropped ears per plot and represents the percentage of plants that did not drop ears prior to harvest.

EAR HT=EAR HEIGHT. The ear height is a measure from the ground to the top developed ear node attachment and is measured in inches.

EAR SZ=EAR SIZE. A 1 to 9 visual rating of ear size. The higher the rating the larger the ear size.

EST CNT=EARLY STAND COUNT. This is a measure of the stand establishment in the spring and represents the number of plants that emerge on a per plot basis for the inbred or hybrid.

GDU SHD=GDU TO SHED. The number of growing degree units (GDUs) or heat units required for an inbred line or hybrid to have approximately 50 percent of the plants shedding pollen and is measured from the time of planting. Growing degree units are calculated by the Barger Method, where the heat units for a 24-hour period are:

$$GDU = \frac{(\text{Max. temp.} + \text{Min. temp.})}{2} - 50$$

The highest maximum temperature used is 86° F. and the lowest minimum temperature used is 50° F. For each inbred or hybrid it takes a certain number of GDUs to reach various stages of plant development.

GDU SLK=GDU TO SILK. The number of growing degree units required for an inbred line or hybrid to have approximately 50 percent of the plants with silk emergence from time of planting. Growing degree units are calculated by the Barger Method as given in GDU SHD definition.

GRN QUL=GRAIN QUALITY. This is a 1 to 9 rating for the general quality of the shelled grain as it is harvested based on such factors as the color of the harvested grain, any mold on the grain, and any cracked grain. High scores indicate good grain quality.

KER LB=KERNELS PER POUND. This is the number of kernels per 0.1 pound.

KSZ L=KERNEL SIZE LARGE. Percentage by weight of shelled corn that passes through a screen with 25/64 inch diameter openings but does not pass through a screen with 22/64 inch diameter openings.

KSZ MF=KERNEL SIZE MEDIUM FLAT. Percentage by weight of shelled corn that passes through a screen with 22/64 inch diameter openings and a screen with 13/64 inch wide slot screen but does not pass through a screen with 18.5/64 inch diameter openings.

KSZ MR=KERNEL SIZE MEDIUM ROUND. Percentage by weight of shelled corn that passes through a screen with 22/64 inch diameter openings but does not pass through a 13/64 inch wide slot screen or a screen with 18.5/64 inch diameter openings.

KSZ S=KERNEL SIZE SMALL. Percentage by weight of shelled corn that through with 18 /64 inch diameter openings ut does not pass through a screen with 16/64 inch diameter openings.

KSZ TIP=KERNEL SIZE TIPS. Percentage by weight of shelled corn that passes through a screen with 16/64 inch diameter openings.

KSZ XL=KERNEL SIZE EXTRA LARGE. Percentage by weight of shelled corn that does not pass through a screen with 25/64 inch diameter openings.

MST=HARVEST MOISTURE. The moisture is the actual percentage moisture of the grain at harvest.

PLT HT=PLANT HEIGHT. This is a measure of the height of the plant from the ground to the tip of the tassel in inches.

POL WT=POLLEN WEIGHT. This is the weight of pollen per 100 plants taken on a plot basis. **ABS** refers to data in absolute, and **% MN** refers to data presented as percentage of experimental mean.

PRM=PREDICTED RM. This trait, predicted relative maturity (RM), is based on the harvest moisture of the grain. The relative maturity rating is based on a known set of checks and utilizes standard linear regression analyses and is referred to as the Minnesota Relative Maturity Rating System.

RT LDG=ROOT LODGING. Root lodging is the percentage of plants that do not root lodge; plants that lean from the vertical axis at an approximately 30° angle or greater would be counted as root lodged.

SCT GRN=SCATTER GRAIN. A 1 to 9 visual rating indicating the amount of scatter grain (lack of pollination or kernel abortion) on the ear. The higher the score the less scatter grain.

SDG VGR=SEEDLING VIGOR. This is the visual rating (1 to 9) of the amount of vegetative growth after emergence at the seedling stage (approximately five leaves). A higher score indicates better vigor.

SEL IND=SELECTION INDEX. The selection index gives a single measure of the hybrid's worth based on information for up to five traits. A corn breeder may utilize his or her own set of traits for the selection index. One of the traits that is almost always included is yield. The selection index data presented in the tables represent the mean value averaged across testing stations.

STA GRN=STAY GREEN. Stay green is the measure of plant health near the time of black layer formation (physiological maturity). A high score indicates better late-season plant health.

STK CNT=NUMBER OF PLANTS. This is the final stand or number of plants per plot.

STK LDG=STALK LODGING. This is the percentage of plants that did not stalk lodge (stalk breakage) as measured by either natural lodging or pushing the stalks and determining the percentage of plants that break below the ear.

TAS BLS=TASSEL BLAST. A 1 to 9 visual rating was used to measure the degree of blasting (necrosis due to heat stress) of the tassel at time of flowering. A 1 would indicate a very high level of blasting at time of flowering, while a 9 would have no tassel blasting.

TAS SZ=TASSEL SIZE. A 1 to 9 visual rating was used to indicate the relative size of the tassel. The higher the rating the larger the tassel.

TAS WT=TASSEL WEIGHT. This is the average weight of a tassel (grams) just prior to pollen shed.

TEX EAR=EAR TEXTURE. A 1 to 9 visual rating was used to indicate the relative hardness (smoothness of crown) of mature grain. A 1 would be, very soft (extreme dent) while a 9 would be very hard (flinty or very smooth crown).

TILLER=TILLERS. A count of the number of tillers per plot that could possibly shed pollen was taken. Data is given as percentage of tillers: number of tillers per plot divided by number of plants per plot.

TST WT=TEST WEIGHT UNADJUSTED. The measure of the weight of the grain in pounds for a given volume (bushel).

TST WTA=TEST WEIGHT ADJUSTED. The measure of the weight of the grain in pounds for a given volume (bushel) adjusted for percent moisture.

YLD=YIELD. It is the same as BU ACR ABS.

YLD SC=YIELD SCORE. A 1 to 9 visual rating was used to give a relative rating for yield based on plot ear piles. The higher the rating the greater visual yield appearance.

CLN=Corn Lethal Necrosis (MCMV=Maize Chlorotic Mottle Virus and MDMV=Maize Dwarf Mosaic Virus): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

MDM CPX=Maize Dwarf Mosaic Complex (MDMV=Maize Dwarf Mosaic Virus and MCDV=Maize Chlorotic Dwarf Virus): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

COM SMT=Common Smut (*Ustilago maydis*): Percentage of plants that did not have infection.

ANT ROT=Anthracnose Stalk Rot (*Colletotrichum graminicola*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

SLF BLT=Southern Leaf Blight (*Bipolaris maydis*, *Helminthosporium maydis*): Visual rating (1-9 score) where a "1" is very susceptible and "9" is very resistant.

NLF BLT=Northern Leaf Blight (*Exserohilum turcicum*, *H. turcicum*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

HC BLT=Helminthosporium Carbonum Leaf Blight (*Bipolariszeicola*, *H. carbonum*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

COM RST=Common Rust (*Puccinia sorghi*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

SO RST=Southern Rust (*Puccinia polysora*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

EYE SPT=Eyespot (*Kabatiella zeae*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

GLF SPT=Gray Leaf Spot (*Cercospora zeae-maydis*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

STW WLT=Stewart's Wilt (*Erwinia stewartii*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

GOS WLT=Goss's Wilt (*Corynebacterium nebraskense*): Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant.

HD SMT=Head Smut (*Spacelotheca reiliana*): Percentage of plants that did not have infection.

DNY MIL=Downy Mildew (*Peronosclerospora sorghi*): Percentage of plants that did not have infection.

FUS EAR=Fusarium Ear Mold (*Fusarium moniliforme*): Percentage of plants that did not have infection.

EAR MLD=General Ear Mold: Visual rating (1-9 score) where a "1" is very susceptible and a "9" is very resistant. This is based on overall rating for ear mold of without determining specific mold organism, and may not be predictive for a specific ear mold.

ECB DPE=Dropped ears due to European Corn Borer (*Ostrinia nubilalis*): Percentage of plants that did not drop ears under second brood corn borer infestation.

ECB 2SC=European Corn Borer Second Brood (*Ostrinia nubilalis*): Visual rating (1-9 score) of post flowering damage due to infestation by European Corn Borer. A "1" is very susceptible and a "9" is very resistant.

ECB 1LF=European Corn Borer First Brood (*Ostrinia nubilalis*): Visual rating (1-9 score) of pre-flowering leaf feeding by European Corn Borer. A "1" is very susceptible and a "9" is very resistant.

ECB 2IT=European Corn Borer Second Brood Tunneling (*Ostrinia nubilalis*): The average inches of tunneling in the stalk due to second brood (post-flowering) European Corn Borer infestation. Determined by splitting stalks with a knife, from four internodes above the ear to the ground.

DETAILED DESCRIPTION OF THE INVENTION

Inbred Corn Line PHV37 is a yellow, dent corn inbred with superior characteristics and provides an excellent female parental line in crosses for producing first generation F₁ corn hybrids. This inbred is best adapted over the Northern region of the United States. The inbred can be used to produce hybrids from approximately 100-115 relative maturity based on the Minne-

sota Relative Maturity Rating System for harvest moisture of grain. PHV37 is a very acceptable female parent because of its high yields, acceptable sizing and good cold test scores. It is not acceptable for use as a male parent because of marginal pollen shed. PHV37 was only 47% of the experimental mean for amount of pollen in the pollen yield test averaged over 5 locations.

The inbred has shown uniformity and stability within the limits of environmental influence for all the traits as described in the Variety Description Information (Table 1) that follows. Most of the data in the Variety Description Information was collected at Johnston, Iowa. The inbred has been self-pollinated and ear-rowed a sufficient number of generations with careful attention paid to uniformity of plant type to ensure homozygosity and phenotypic stability. The line has been increased both by hand and in isolated fields with continued observations for uniformity. No variant traits have been observed or are expected in PHV37.

Inbred corn line PHV37, being substantially homozygous, can be reproduced by planting seeds of the line, growing the resulting corn plants under self-pollinating or sib-pollinating conditions with adequate isolation, and harvesting the resulting seed, using techniques familiar to the agricultural arts.

TABLE 1

PHV37 VARIETY DESCRIPTION INFORMATION	
Type: Dent	Region Best Adapted: North
A. Maturity: Averaged across Northern maturity zone.	
Zone: 2	
INBRED = PHV37	
Heat Unit Shed: 1410	
Heat Unit Silk: 1440	
No. Reps: 30	
$\text{HEAT UNITS} = \frac{[\text{Max. Temp. } (< -86^\circ \text{ F.}) + \text{Min. Temp. } (> -50^\circ \text{ F.})^*]}{2} - 50$	

*If maximum is greater than 86 degrees fahrenheit, then 86 is used and if minimum is less than 50, then 50 is used. Heat units accumulated daily and can not be less than 0.

- B. Plant Characteristics:
 Plant height (to tassel tip): 214 cm
 Length of top ear internode: 13 cm
 Number of ears per stalk: Single
 Ear height (to base of top ear): 71 cm
 Number of tillers: None
 Cytoplasm type: Normal
- C. Leaf:
 Color: (B14) Dark green
 Angle from Stalk: 30-60 degrees
 Marginal Waves: (OH7L) Many
 Number of Leaves (mature plants): 19
 Sheath Pubescence: (W22) Light
 Longitudinal Creases: (PA11) Many
 Length (Ear node leaf): 76 cm
 Width (widest point, ear node leaf): 8 cm
- D. Tassel:
 Number lateral branches: 5
 Branch Angle from central spike: <30 degrees
 Pollen Shed: Light based on pollen Yield Test (47% of experiment mean).
 Peduncle Length (top leaf to basal branches): 22 cm
 Anther Color: Yellow with slight pink
 Glume Color: Green
- E. Ear (Husked Ear Data Except When Stated Otherwise):
 Length: 14 cm
 Weight: 105 gm
 Mid-point Diameter: 43 mm
 Silk Color: Green
 Husk Extension (Harvest stage): Very Long (>10 cm)
 Husk Leaf: Long (>15 cm)
 Taper of Ear: Slight taper

TABLE 1-continued

PHV37 VARIETY DESCRIPTION INFORMATION	
5	Position of Shank (dry husks): Horizontal Kernel Rows: Distinct, slightly curved, Number = 16 Husk Color (fresh): Light green Husk Color (dry): Buff Shank Length: 12 cm Shank (No. of internodes): 9
10	F. <u>Kernel (Dried):</u> Size (from ear mid-point) Length: 11 mm Width: 9 mm Thick: 5 mm Shape Grade (% rounds): 20-40% medium rounds based on Parent Test.
15	Pericarp Color: Colorless Aleurone Color: Homozygous yellow Endosperm Color: Yellow Endosperm Type: Normal Gm Wt/100 Seeds (unsized): 30 gm
20	G. <u>Cob:</u> Diameter at mid-point: 26 mm Strength: Strong Color: Red
25	H. <u>Diseases:</u> Corn Lethal Necrosis (MCMV = Maize Chlorotic Mottle Virus and MDMV = Maize Dwarf Mosaic Virus): Resistant Anthracnose Stalk Rot (<i>C. Graminicola</i>): Intermediate N. Leaf Blight (<i>H. Turcicum</i>): Intermediate Carbonum Leaf Blight (<i>H. Carbonum</i>): Susceptible Common Rust (<i>P. Sorghi</i>): Susceptible Eye Spot (<i>K. Zeae</i>): Intermediate
30	Gray Leaf Spot (<i>C. Zeae</i>): Intermediate Stewarts Wilt (<i>E. Stewartii</i>): Resistant Goss's Wilt (<i>C. Nebraskense</i>): Resistant Common Smut (<i>U. Maydis</i>): Intermediate Head Smut (<i>S. Reiliana</i>): Resistant Fusarium Ear Mold (<i>F. Moniliforme</i>): Intermediate
35	I. <u>Insects:</u> European Corn Borer-1 Leaf Damage (Pre-flowering): Intermediate European Corn Borer-2 (Post-flowering): Intermediate
40	J. <u>Variety Most Closely Resembling:</u> Character Inbred Maturity BO9 Usage PHK29

BO9 (PVP Certificate No. 8300142) and PHK29 (PVP Certificate No. 8700214 and U.S. Pat. No. 4,812,600) are Pioneer proprietary inbreds. BO9 is quickly declining in usage but is of similar maturity.

Data for items B, C, D, E, F, and G are primarily based on a maximum of three reps of data from Johnston, Iowa in 1987 and 1988, plus description information from the maintaining station.

TABLE 2

ELECTROPHORESIS RESULTS Isozyme Genotypes for PHV37	
55	Isozyme data was generated for inbred corn line PHV37 according to the procedure described in Goodman, M. M. and Stuber, C. M., "Genetic identification of lines and crosses using isoenzyme electrophoresis," Proceedings of the Thirty-Fifth Annual Corn and Sorghum Industry Research Conference, Chicago, Illinois (1980).
Alleles Present	
Loci PHV37	
60	ACP1 4
	ADH1 4
	CAT3 9
	DIA1 8
65	GOT1 4
	GOT2 4
	GOT3 4
	IDH1 4
	IDH2 6

TABLE 2-continued

ELECTROPHORESIS RESULTS	
Isozyme Genotypes for PHV37	
Isozyme data was generated for inbred corn line PHV37 according to the procedure described in Goodman, M. M. and Stuber, C. M., "Genetic identification of lines and crosses using isoenzyme electrophoresis." Proceedings of the Thirty-Fifth Annual Corn and Sorghum Industry Research Conference, Chicago, Illinois (1980).	
Alleles Present	
Loci	PHV37
MDH1	6
MDH2	6
MDH3	16
MDH4	12
MDH5	12
MMM	4
PGM1	9
PGM2	4
PGD1	2
PGD2	5
PHI1	4

INDUSTRIAL APPLICABILITY

This invention also is directed to methods for producing a corn plant by crossing a first parent corn plant with a second parent corn plant wherein the first or second parent corn plant is an inbred corn plant from the line PHV37. Further, both first and second parent corn plants can come from the inbred corn line PHV37. Thus, any such methods using the inbred corn line PHV37 are part of this invention: selfing, backcrosses, hybrid production, crosses to populations, and the like. All plants produced using inbred corn line PHV37 as a parent are within the scope of this invention. Advantageously, the inbred corn line is used in crosses with other, different, corn inbreds to produce first generation (F₁) corn hybrid seeds and plants with superior characteristics.

As used herein, the terms "plant and plant parts" include plant cells, plant protoplasts, plant cell tissue culture from which corn plants can be regenerated, plant calli, plant clumps, and plant cells that are intact in plants or parts of plants, such as embryos, pollen, flowers, kernels, ears, cobs, leaves, husks, stalks, roots, root tips, anthers, silk and the like.

Tissue culture of corn is described in European Patent Application, publication 160,390, incorporated herein by reference. Corn tissue culture procedures are also described in Green and Rhodes, "Plant Regeneration in Tissue Culture of Maize," *Maize for Biological Research* (Plant Molecular Biology Association, Charlottesville, Va. 1982, at 36-372. Thus, another aspect of this invention is to provide cells which upon growth and differentiation produce the inbred line PHV37.

The utility of inbred line PHV37 also extends to crosses with other species. Commonly, suitable species will be of the family Gramineae, and especially of the genera *Zea*, *Tripsacum*, *Coix*, *Schlerachne*, *Polytoca*, *Chionachne*, and *Trilobachne*, of the tribe Maydeae. Of these, *Zea* and *Tripsacum*, are most preferred. Potentially suitable for crosses with PHV37 may be the various varieties of grain sorghum, *Sorghum bicolor* (L.) Moench.

Corn is used as human food, livestock feed, and as raw material in industry. The food uses of corn, in addition to human consumption of corn kernels, include both products of dry- and wet-milling industries and alkaline cooking. The principal products of corn dry milling are grits, meal and flour. The corn wet-milling

industry can provide corn starch, corn syrups, and dextrose for food use. Alkaline cooking provides snack foods (i.e., corn chips, tortillas, etc.) Corn oil is recovered from corn germ, which is a by-product of both dry- and wet-milling industries.

Corn, including both grain and non-grain portions of the plant, is also used extensively as livestock feed, primarily for beef cattle, dairy cattle, hogs, and poultry.

Industrial uses of corn are mainly from corn starch from the wet-milling industry and corn flour from the dry-milling industry. The industrial applications of corn starch and flour are based on functional properties, such as viscosity, film formation, adhesive properties, and ability to suspend particles. The corn starch and flour have application in the paper and textile industries. Other industrial uses include applications in adhesives, building materials, foundry binders, laundry starches, explosives, oil-well muds, and other mining applications.

Plant parts other than the grain of corn are also used in industry. Stalks and husks are made into paper and wallboard and cobs are used for fuel and to make charcoal.

The seed of inbred corn line PHV37, the plant produced from the inbred seed, the hybrid corn plant produced from the crossing of the inbred, hybrid seed, and various parts of the hybrid corn plant can be utilized for human food, livestock feed, and as a raw material in industry.

EXAMPLE Inbred and Hybrid Performance of PHV37

In the examples that follow the traits and characteristics of inbred corn line PHV37 are given as a line and in hybrid combination. The data collected on inbred corn line PHV37 is presented for the key characteristics and traits.

The results in Table 3 compare PHV37 to PHK29. PHK29 (PVP Certificate #8700214, Pat. No. 4,812,600) is an important inbred that would be used as a female in some of the areas that PHV37 would be used and would cross well with some of the same inbred lines. This data has been collected over three years of research testing. The results show that the two lines differ significantly for a number of traits. PHV37 averaged 8.2 more bushels per acre in yield than PHK29. PHV37 had fewer barren plants, better early stand count, cold test, better seedling vigor, was earlier to flower, shorter and had higher grain test weight than PHK29.

The results in Table 4 compare PHV37 to PHK29 crossed to the same inbred testers. The results show that the two lines differ significantly for a number of traits in hybrid combination. The PHV37 hybrids were earlier in maturity (flowering and harvest moisture of the grain) than the PHK29 hybrids. The PHV37 hybrids scored higher in seedling vigor and early stand count than the PHK29 hybrids indicating that they would have excellent stand establishment in the spring.

The results in Table 5 compare a PHV37 hybrid to Pioneer® brand hybrid 3569. These hybrids have a parent in common that is not PHV37. The PHV37 hybrid would be utilized in some of the same western Corn Belt area that 3569 is currently being used. The comparison shows that the PHV37 hybrid is earlier maturing for flowering and for harvest moisture of the grain, is a shorter plant with lower ear height than 3569 and has better grain quality than 3569. In farmer grown strip

test the PHV37 hybrid yielded only 2 bushels per acre less than 3569 and was 2.7 points drier in the western Corn Belt averaged over 17 comparisons. The earlier

layer will allow the PHV37 hybrid to be grown at higher elevations than 3569 and it will complement 3569 in the western Corn Belt.

TABLE 3

PAIRED INBRED COMPARISON DATA											
INBRED #1 - PHV37											
INBRED #2 - PHK29											
YEAR	VAR #	BU ACR ABS	BU ACR % MN	BAR PLT ABS	BRT STK ABS	EAR HT ABS	EAR SZ ABS	ES CNT ABS	CLD TST ABS	CLD TST % MN	
TOTAL	1	66.3	112	91.0	27.9	26.0	5.4	32.7	90.8	106	
SUM	2	58.1	100	86.1	99.3	32.8	5.9	31.5	83.1	97	
	LOCS	23	23	26	4	28	16	88	13	13	
	DIFF	8.2	12	4.9	1.3	6.8	0.6	1.2	7.8	9	
	PROB	.045+	.084*	.025+	.290	.000#	.167	.002#	.020+	.019+	
YEAR	VAR #	DRP EAR ABS	TIL LER ABS	GDU SHD ABS	GDU SLK ABS	GRN QUL ABS	KER LB ABS	KSZ XL ABS	KSZ L ABS	KSZ MR ABS	
TOTAL	1	99.8	0.5	140.7	143.5	6.7	149.9	2.5	31.7	28.8	
SUM	2	99.9	1.4	152.0	155.7	6.5	166.7	0.3	17.7	36.5	
	LOCS	13	23	64	60	17	12	6	6	6	
	DIFF	0.1	0.9	11.3	12.3	0.2	16.8	2.2	14.0	7.7	
	PROB	.610	.243	.000#	.000#	.555	.000#	.034+	.027+	.219	
YEAR	VAR #	KSZ MF ABS	KSZ S ABS	KSZ TIP ABS	MST ABS	PLT HT ABS	POL SC ABS	RT LDG ABS	TAS SZ ABS	TEX EAR ABS	
TOTAL	1	26.8	8.7	1.4	20.6	74.2	3.8	73.2	4.0	6.0	
SUM	2	31.3	13.2	1.0	23.5	81.3	5.1	99.5	4.8	6.2	
	LOCS	6	6	5	23	29	31	7	29	12	
	DIFF	4.5	4.5	0.4	2.8	7.1	1.4	26.3	0.8	0.2	
	PROB	.397	.079*	.178	.000#	.000#	.000#	.091*	.002#	.551	
YEAR	VAR #	TST WT ABS	SCT GRN ABS	SDG VGR ABS	STA GRN ABS	STK CNT ABS	STK LDG ABS	YLD SC ABS	COM RST ABS	COM SMT ABS	EAR MLD ABS
TOTAL	1	57.1	6.1	6.2	3.9	30.3	92.1	5.8	3.0	0.0	6.9
SUM	2	56.0	5.9	5.7	7.8	29.6	96.4	6.1	3.0	0.0	6.7
	LOCS	23	25	45	23	74	16	27	1	1	25
	DIFF	1.1	0.2	0.5	3.9	0.6	4.4	0.3	0.0	0.0	0.2
	PROB	.052*	.606	.055*	.000#	.058*	.139	.294			.419
YEAR	VAR #	ECB DPE ABS	ECB 1LF ABS	ECB 2SC ABS	EYE SPT ABS	GLF SPT ABS	HC BLT ABS	NLF BLT ABS	SLF BLT ABS	SO RST ABS	STW WLT ABS
TOTAL	1	99.4	6.7	5.9	5.5	2.8	2.0	3.7	4.0	4.5	6.5
SUM	2	100.0	4.8	6.6	5.5	2.5	7.0	4.0	5.0	5.5	8.0
	LOCS	2	20	12	2	2	1	3	1	1	2
	DIFF	0.6	1.9	0.7	0.0	0.3	5.0	0.3	1.0	1.0	1.5
	PROB	.500	.000#	.249	1.00	.500		.423			.205

* = 10% SIG

+ = 5% SIG

= 1% SIG

maturity for flowering, harvest moisture and black

TABLE 4

Average Inbred by Tester Performance Comparing PHV37 to PHK29 crossed to the same Inbred Testers and Grown in the Same Experiments. All Values are Expressed as percent of the experiment mean except Predicted RM, Selection Index, and Yield (Bu./Ac.).											
Inbred	PRM	SEL IND	BU ACR	MST YLD	GDU SHD	STK LDG	RT LDG	BAR PLT	STA GRN		
TOTAL REPLIC.	114	114	114	114	114	24	108	25	34	55	
MEAN WTS PHK29	111	106	123	106	104	102	99	104	100	121	
MEAN WTS PHV37	107	100	116	99	95	97	94	97	102	86	
DIFF.	4	6	7	7	9	5	4	7	1	35	
Inbred	TST WTA	COB SC	GRN QUL	SDG VGR	EST CNT	PLT HT	EAR HT	DRP EAR	BRT STK		
TOTAL REPLIC.	114	2	44	50	58	45	45	76	4		
MEAN WTS PHK29	100	117	107	90	95	100	99	100	100		
MEAN WTS PHV37	99	117	104	103	101	100	97	100	100		
DIFF.	1		3	13	6	0	2	0			

TABLE 5

#1 - PHV37 HYBRID											
#2 - PIONEER ® BRAND 3569											
YEAR	VAR #	SEL IND	PRM	BU ACR ABS	MST ABS	GDU SHD ABS	STK LDG ABS	RT LDG ABS	BAR PLT ABS	STA GRN ABS	
TOTAL	1	97	103	123.1	18.8	131.0	88.5	91.0	86.7	3.9	
SUM	2	105	107	134.4	20.0	135.5	88.7	95.2	86.6	5.4	
	LOCS	24	24	127	127	27	122	37	24	64	
	DIFF	8	4	11.3	1.3	4.5	0.2	4.2	0.2	1.5	
	PROB	.002#	.000#	.000#	.000#	.000#	.772	.041+	.906	.000#	
YEAR	VAR #	TST WTA ABS	COB SC ABS	GRN QUL ABS	SDG VGR ABS	EST CNT ABS	PLT HT ABS	EAR HT ABS	DRP EAR ABS	BRT STK ABS	
TOTAL	1	57.5	7.5	6.6	6.0	62.9	99.2	44.1	98.7	97.3	
SUM	2	57.6	4.5	6.2	5.9	62.6	100.7	45.4	98.7	98.1	
	LOCS	126	1	66	52	85	58	58	98	12	
	DIFF	0.2	3.0	0.3	0.1	0.4	1.5	1.4	0.0	0.8	
	PROB	.030+		.018+	.508	.572	.004#	.000#	.993	.341	

* = 10% SIG

+ = 5% SIG

= 1% SIG

Deposits

Applicant has made available to the public without restriction a deposit of at least 2500 seeds of inbred PHV37 with the American Type Culture Collection (ATCC), Rockville, Md. 20852, U.S.A., ATCC Deposit No. 75222. The seeds deposited with the ATCC are taken from the same deposit maintained by Pioneer Hi-Bred International, Inc., 700 Capital Square, 400 Locust Street, Des Moines, Iowa 50309, since prior to the filing date of this application. The deposit of the Inbred corn line PHV37 will be maintained without restriction at the ATCC Depository, which is a public depository, for a period of 30 years, or five years after the most recent request, or for the effective life of the

patent, whichever is longer, and will be replaced if it becomes nonviable during that period.

What is claimed is:

1. Inbred corn seed designated PHV37 having ATCC accession No. 75222.

2. A corn plant produced by the seed of claim 1.

3. A tissue culture of regenerable cells of the plant of claim 2.

4. A corn plant regenerated from the tissue culture of claim 3.

5. An inbred corn plant having all the physiological and morphological characteristics of the plant of claim 2.

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