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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE

Exhibit C

OBJECTIVE DESCRIPTION OF VARIETY
Potato (*Solanum tuberosum* L.)

INSTRUCTIONS

The Objective Description Form:

The objective description form lists characteristics to be used as the basis for developing the description of potato varieties. It is designed to guide the applicant in describing a variety in detail so a meaningful comparison with other potato varieties can be accomplished. It is recommended that this form be completed in as much detail as possible to ensure an accurate description. Please fill in the requested data and place the appropriate number that describes the varietal characters typical of this potato variety and the reference varieties in the respective boxes.

Test Guidelines:

Any statistical and trial (field test) data that may be necessary to support the variety description should be attached to this form. Please include for trial data the plot size, number of replications, number of plants, plant spacing, trial locations and growing periods. Trials should normally be conducted at one place, in the region that the variety has been adapted. All comparative data should be determined from varieties entered in the same trials. The size of the plots should be such that plants or parts of plants may be removed for measuring and counting without prejudice to the observations which must be made at the end of the growing period. As a minimum, each test should include a total of 60 plants which should be divided between two or more replicates. Separate plots for observation and measuring can only be used if they have been subject to similar environmental conditions. To determine color for a plant or plant parts a recognized standard color chart must be used such as the Royal Horticultural Society (RHS) Color Chart or Munsell Color Chart (MCC).

Reference Varieties:

The application variety should be compared to at least one reference variety preferably a set of reference varieties. The reference varieties should be market class standard varieties currently grown in the United States and or the variety (ies) most similar. The following varieties are recommended as market class standards to be used as reference varieties:

- Yellow-flesh table-stock Yukon Gold
- Round-white table-stock..... Superior
- Chip-processing Atlantic, Snowden, Norchip
- Frozen-processing Russet Burbank
- Russet table-stock..... Russet Burbank, Russet Norkotah, Goldrush
- Red table-stock Red Pontiac, Red Norland, Red Lasoda

If the applicant does not use one of the recommended reference varieties by the PVP office, a complete description of the reference variety should be submitted by the applicant (Exhibit C).

Characteristics:

Light sprout characteristics are supplied in Figure 1. The plant type and growth habit characteristics are collected at early first bloom. Figure 2 is supplied to help visualize the growth habit. For this descriptor, look at the stems rather than the stems and foliage. Plant maturity is measured at natural vine senescence.

Stem characteristics are also collected at early bloom. Stem anthocyanin coloration is divided into two descriptors: Location and intensity. Figure 3 is supplied to give an example of stem wings.

Leaf characteristics are observed at early first bloom. Fully-developed leaves located on the middle third of the plant should be used. Leaf pubescence refers to general trichomes. Figure 4 is supplied for examples of leaf silhouette. Leaf stipules are shown in Figure 5 for visual definition. Figure 6 is supplied to define leaf characteristics. Figure 7 should be used to describe terminal and primary leaflet shape. Figures 8 and 9 are used to describe the terminal and primary leaflet shape of tip and base, respectively. To measure the total number of primary leaflets pairs, collect 10 fully developed petioles (with leaves attached from each replication) and take the average number of secondary and tertiary leaflets. Glandular trichomes should be described in the Additional Comments and Characteristics (Descriptor 15).

Inflorescence characteristics should be measured at early first bloom. Figures 10, 11 and 12 are supplied to describe anther and stigma shape, respectively. Corolla, calyx, anther, stigma, and pollen should be observed on newly opened flowers. Berry production should be based on field-grown plants rather than greenhouse plants.

Tuber characteristics should be observed following harvest. Figures 13 and 14 are available to describe distribution of secondary color and tuber shape, respectively.

Disease and pest reactions should be based upon specific tests or statistical analysis rather than just field observations, rating 1 as Highly Resistance and 9 as Highly Susceptible, please follow the scale on each descriptor. Other diseases or pests reactions not requested can be described if it is felt that it would be helpful to determine novelty of the variety.

Quality characteristics should be described according to the market use.

If the plant is transgenic, this gene insertion(s) should be described.

Chemical identification and any other characteristics can be described if they are helpful in distinguishing the variety.

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

1. MARKET CHARACTERISTICS:___ **MARKET CLASS:**

1 = Yellow-flesh Tablestock 2 = Round-white Tablestock 3 = Chip-processing 4 = Frozen-processing
 5 = Russet Tablestock 6 = Other _____

2. LIGHT SPROUT CHARACTERISTICS: (See Figure 1)___ **LIGHT SPROUT: GENERAL SHAPE**

1 = Spherical 2 = Ovoid 3 = Conica 4 = Broad cylindrica 5 = Narrow cylindrical 6 = Other _____

___ **LIGHT SPROUT BASE: PUBESCENCE OF BASE**

1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

___ **LIGHT SPROUT BASE: ANTHOCYANIN COLORATION**

1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

___ **LIGHT SPROUT BASE: INTENSITY OF ANTHOCYANIN COLORATION (IF PRESENT)**

1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

___ **LIGHT SPROUT TIP: HABIT**

1 = Closed 2 = Intermediate 3 = Open

___ **LIGHT SPROUT TIP: PUBESCENCE**

1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

___ **LIGHT SPROUT TIP ANTHOCYANIN COLORATION**

1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

___ **LIGHT SPROUT TIP: INTENSITY OF ANTHOCANIN COLORATION (IF PRESENT)**

1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

___ **LIGHT SPROUT ROOT INITIALS: FREQUENCY**

1 = Absent 2 = Some 3 = Abundant

3. PLANT CHARACTERISTICS:___ **GROWTH HABIT:** (See Figure 2)

3 = Erect (>45° with ground) 5 = Semi-erect (30-45° with ground) 7 = Spreading

___ **TYPE:**

1 = Stem (foliage open, stems clearly visible) 2 = Intermediate 3 = Leaf (Foliage closed, stems hardly visible)

___ **MATURITY: Days after planting (DAP) at vine senescence**

PLANTING DATE: _____

___ **REGIONAL AREA:**

1 = Pacific North West (WA, OR, ID, CO, CA) 2 = North Central (ND, WI, MI, MN, OH) 3 = North East (ME, NY, PA, NJ, MD, MA, RI.)
 4 = Mid-Atlantic Erect (VI, NC, SC, South NJ, FL) 5 = South (LA, TX, AZ, NE) 6 = Canada
 7 = Europe 8 = England 9 = Latin America 10 = Brazil 11 = Other _____

___ **MATURITY CLASS:**

1 = Very Early (<100 DAP) 2 = Early (100-110 DAP) 3 = Mid-season (111-120 DAP) 4 = Late (121-130 DAP) 5 = Very Late (>130 DAP).

4. STEM CHARACTERISTICS: Measure at early first bloom

1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong

___ **STEM ANTHOCYANIN COLORATION:**___ **STEM WINGS:** (See Figure 3)

5. LEAF CHARACTERISTICS:

- ___ **LEAF COLOR:** (*Observe fully developed leaves located on middle 1/3 of plant*)
 1 = Yellowing-green 2 = Olive-green 3 = Medium Green 4 = Dark Green 5 = Grey-green 6 = Other _____
- ___ **LEAF COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart
 (*Observe fully developed leaves located on middle 1/3 of plant and circle the appropriate color chart*)
- ___ **LEAF PUBESCENCE DENSITY:**
 1 = Absent 2 = Sparse 3 = Medium 4 = Thick 5 = Heavy
- ___ **LEAF PUBESCENCE LENGTH:**
 1 = None 2 = Short 3 = Medium 4 = Long 5 = Very Long
- (*Note Descriptor #15 (Additional Comments and Characteristics) can be used to describe the type and length of the glandular trichomes observed.*)
- ___ **LEAF SILHOUETTE:** (See Figure 4)
 1 = Closed 3 = Medium 5 = Open
- ___ **PETIOLES ANTHOCYANIN COLORATION:**
 1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong
- ___ **LEAF STIPULES SIZE:** (See Figure 5)
 1 = Absent 3 = Small 5 = Medium 7 = Large
- ___ **TERMINAL LEAFLET SHAPE** (See Figures 6 and 7)
 1 = Narrowly ovate 2 = Medium Ovate 3 = Broadly Ovate 4 = Lanceolate 5 = Elliptical 6 = Obovate 7 = Oblong 8 = Other _____
- ___ **TERMINAL LEAFLET TIP SHAPE:** (See Figures 6 and 8)
 1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____
- ___ **TERMINAL LEAFLET BASE SHAPE:** (See Figure 9)
 1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____
- ___ **TERMINAL LEAFLET MARGIN WAVINESS:**
 1 = Absent 2 = Slight 3 = Weak 4 = Medium 5 = Strong
- NUMBER OF PRIMARY LEAFLET PAIRS:** (See Figure 6)
- AVERAGE:** _____
- RANGE:** _____ to _____
- ___ **PRIMARY LEAFLET TIP SHAPE:** (See Figures 6 and 8)
 1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____
- ___ **PRIMARY LEAFLET SIZE:**
 1 = Very Small 2 = Small 3 = Medium 4 = Large 5 = Very Large
- ___ **PRIMARY LEAFLET SHAPE:** (See Figures 6 and 7)
 1 = Narrowly ovate 2 = Medium ovate 3 = Broadly ovate 4 = Lanceolate 5 = Elliptical 6 = Ovate 7 = Oblong 8 = Other _____
- ___ **PRIMARY LEAFLET BASE SHAPE:** (See Figures 6 and 9)
 1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____
- NUMBER OF SECONDARY AND TERTIARY LEAFLET PAIRS:** (See Figure 6)
- AVERAGE:** _____
- RANGE:** _____ to _____
- NUMBER OF INFLORESCENCE/PLANT:**
- AVERAGE:** _____
- RANGE:** _____ to _____
- NUMBER OF FLORETS/INFLORESCENCE:**
- AVERAGE:** _____
- RANGE:** _____ to _____

5. LEAF CHARACTERISTICS: (continued)

- ___ **COROLLA INNER SURFACE COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)
- ___ **COROLLA OUTER SURFACE COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)
- ___ **COROLLA INNER SURFACE COLOR:** (Measure predominant color of newly open flower, if flowers are bi-color please use the ratio codes)
 1 = White 2 = Red-violet 3 = Blue-violet 4 = Cream 5 = Red-purple 6 = Blue 7 = Pink 8 = Pink-white 9 = Purple 10 = Violet
 11 = Purple-violet 13 = Violet-White 1:1 14 = Violet-White 1:3 15 = Violet-White 3:1 16 = Violet-White Halo 17 = Pink-White 1:1 18 = Pink-White 1:3
 19 = Pink-White 3:1 20 = Pink-White Halo 21 = RedViolet-White 1:1 22 = RedViolet-White 1:3 23 = RedViolet-White 3:1 24 = RedViolet-White Halo
 25 = BlueViolet-White 1:1 26 = BlueViolet-White 1:3 27 = BlueViolet-White 3:1 28 = BlueViolet-White Halo
 12 = Other _____
- ___ **COROLLA SHAPE:** (See Figure 10)
 1 = Very rotate 2 = Rotate 3 = Pentagonal 4 = Semi-stellate 5 = Stellate

6. INFLORESCENCE CHARACTERISTICS:

- ___ **CALYX ANTHOCYANIN COLORATION:**
 1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very strong
- ___ **ANTHER COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsel Color Chart (Measure when newly opened flower is fully expanded and circle the appropriate color chart)
- ___ **ANTHER SHAPE:** (See Figure 11)
 1 = Broad cone 2 = Narrow cone 3 = Pear-shaped cone 4 = Loose 5 = Other
- ___ **POLLEN PRODUCTION:**
 1 = None 3 = Some 5 = Abundant
- ___ **STIGMA SHAPE:** (See Figure 12)
 1 = Capitate 2 = Clavate 3 = Bi-lobed
- ___ **STIGMA COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsel Color Chart (Circle the appropriate color chart)
- ___ **BERRY PRODUCTION:** (Under field conditions)
 1 = Absent 3 = Low 5 = Moderate 7 = Heavy 9 = Very Heavy

7. TUBER CHARACTERISTICS:

- ___ **PREDOMINANT SKIN COLOR:**
 1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
 10 = Purple 11 = Dark purple-black 12 = Other _____
- ___ **PREDOMINANT SKIN COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)
- ___ **SECONDARY SKIN COLOR:**
 1 = Absent 2 = Present (please describe)
- ___ **SECONDARY SKIN COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color)
- ___ **SECONDARY SKIN COLOR DISTRIBUTION:** (See Figure 13)
 1 = Eyes 2 = Eyebrows 3 = Splashed 4 = Scattered 5 = Spectacled 6 = Stippled 7 = Other _____
- ___ **SKIN TEXTURE:**
 1 = Smooth 2 = Rough (flaky) 3 = Netled 4 = Russetted 5 = Heavily russetted 6 = Other _____
- ___ **TUBER SHAPE:** (See Figure 14)
 1 = Compressed 2 = Round 3 = Oval 4 = Oblong 5 = Long 6 = Other _____
- ___ **TUBER THICKNESS:**
 1 = Round 2 = Medium thick 3 = Slightly flattened 4 = Flattened 5 = Other _____

TUBER LENGTH (mm):

AVERAGE: _____

RANGE: _____ to _____

___ **STANDARD DEVIATION:**___ **AVERAGE WEIGHT OF SAMPLE TAKEN:**

7. TUBER CHARACTERISTICS: (continued)**TUBER WIDTH (mm)**

AVERAGE: _____

RANGE: _____ to _____

____ STANDARD DEVIATION:

____ AVERAGE WEIGHT OF SAMPLE TAKEN (g):

TUBER THICKNESS (mm):

AVERAGE: _____

RANGE: _____ to _____

____ STANDARD DEVIATION:

____ AVERAGE WEIGHT OF SAMPLE TAKEN (g):

TUBER EYE DEPTH:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

TUBER LATERAL EYES:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

NUMBER EYE/TUBER:

AVERAGE: _____

RANGE: _____ to _____

DISTRIBUTION OF TUBER EYES:

1 = Predominantly apical 2 = Evenly distributed

PROMINENCE OF TUBER EYEBROWS:

1 = Absent 2 = Slight prominence 3 = Medium prominence 4 = Very prominent 5 = Other _____

PREDOMINANT TUBER FLESH COLOR1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
10 = Purple 11 = Dark purple-black 12 = Other _________ **PRIMARY TUBER FLESH COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)**SECONDARY TUBER FLESH COLOR:**

1 = Absent 2 = Present, please describe: _____

____ **SECONDARY TUBER FLESH COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)**NUMBER OF TUBERS/PLANT:**

1 = Low (<8) 2 = Medium (8-15) 3 = High (>15)

8. DISEASES CHARACTERISTICS:____ **DISEASES REACTION:** 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lesions in Number and S
4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible 7 = Susceptible 9 = Highly Susceptible____ **LATE BLIGHT: (Phytophthora)**____ **EARLY BLIGHT: (Alternaria)**____ **SOFT ROT (Erwinia)**____ **COMMON SCAB (Streptomyces)**____ **POWDERY SCAB (Spongospora)**____ **DRY ROT (Fusarium)**____ **POTATO LEAF ROLL VIRUS (PLRV)**____ **POTATO VIRUS X (PVX)**____ **POTATO VIRUS Y (PVY)**

8. DISEASES CHARACTERISTICS: (continued) **POTATO VIRUS M (PVM)** **POTATO VIRUS A (PVA)** **GOLDEN NEMATODE (*Globodera*)** **ROOT – KNOT NEMATODE (*Meloidogyne*)** **OTHER DISEASE** _____ **PHYSIOLOGICAL DISORDER**1 = Malformed shape 2 = Tuber cracking 3 = Feathering 4 = Hollow heart 5 = Internal necrosis 6 = Blackheart 7 = Internal sprouting
8 = Other _____**9. PESTS CHARACTERISTICS:** **PEST REACTION:** 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lesions in Number and Size
4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible 7 = Susceptible 9 = Highly Susceptible **COLORADO POTATO BEETLE (CPB) (*Leptinotarsa*)** **GREEN PEACH APHID (*Myzus*)** **OTHER:** _____ **OTHER:****10. GENE TRAITS:** **INSERTION OF GENES:** 1 = YES 2 = NO

IF YES, describe the gene(s) introduced or attach information:

11. QUALITY CHARACTERISTICS: **CHIEF MARKET:**

SPECIFIC GRAVITY (wt. air/wt. air – wt. water)

1 = <1.060 2 = 1.060-1.069 3 = 1.070-1.079 4 = 1.080-1.089 5 = >1.090

 TOTAL GLYCOALKALOID CONTENT (mg./100 g. fresh tuber)**OTHER QUALITY CHARACTERISTICS:** Describe any other quality characteristics that may aid in identification, (e.g., chip-processing, french fry processing, baking, boiling, after-cooking darkening). Please attach data and corresponding protocol.

12. CHEMICAL IDENTIFICATION:

Describe chemical traits of the candidate variety that aid in its identification (e.g., protien or DSN electrophoresis). Please attach data and the corresponding protocol.

13. FINGER PRINTING MARKERS:

___ **ISOZYMES** 1 = YES 2 = NO

IF YES, attach information

14. ___ DNA PROFILE: 1 = YES 2 = NO

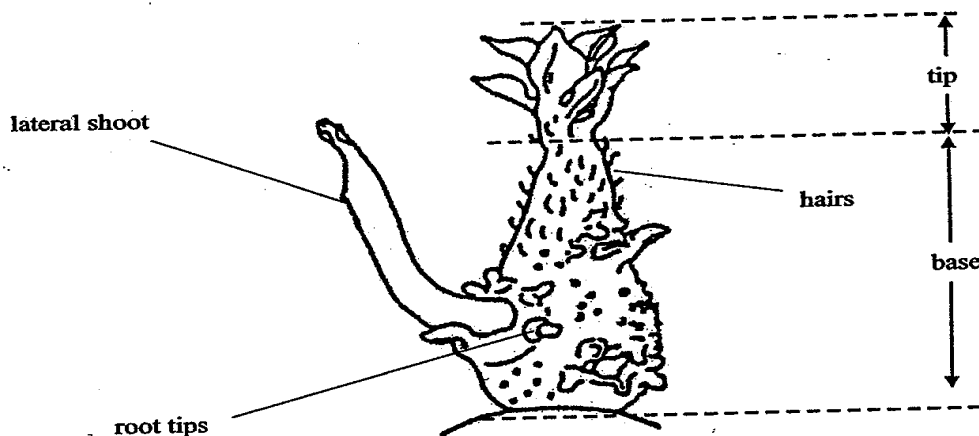
IF YES, attach information

15. ADDITIONAL COMMENTS AND CHARACTERISTICS:

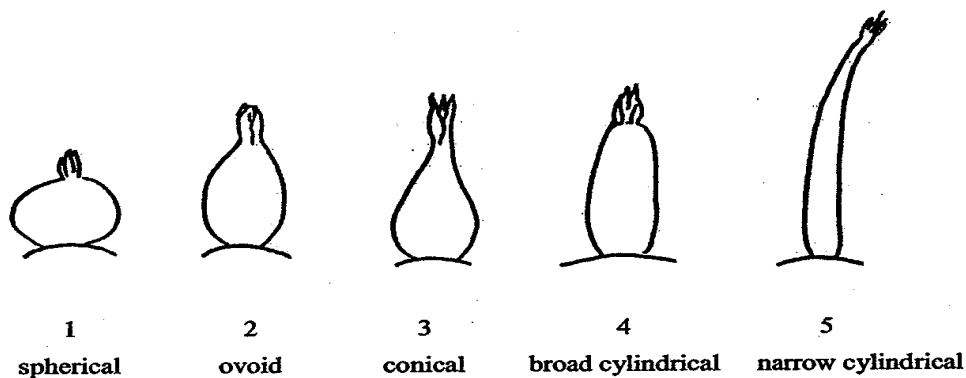
Include any additional descriptors that would be useful in distinguishing the candidate variety.

Figure 1: Light sprout

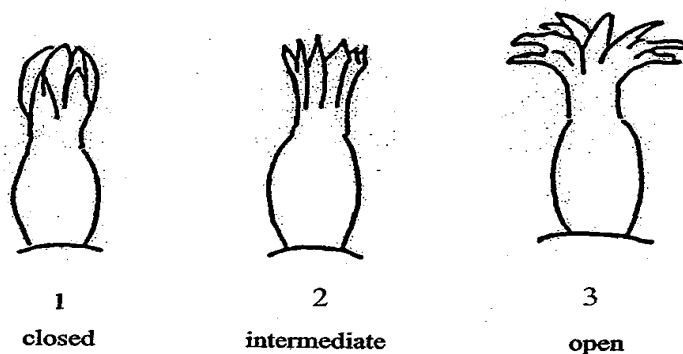
Light sprout dissection



Light sprout shape



Light sprout tip habit



The characteristic should be observed after about 10 weeks to obtain a good differentiation in the collection.

Figure 2: Growth Habit

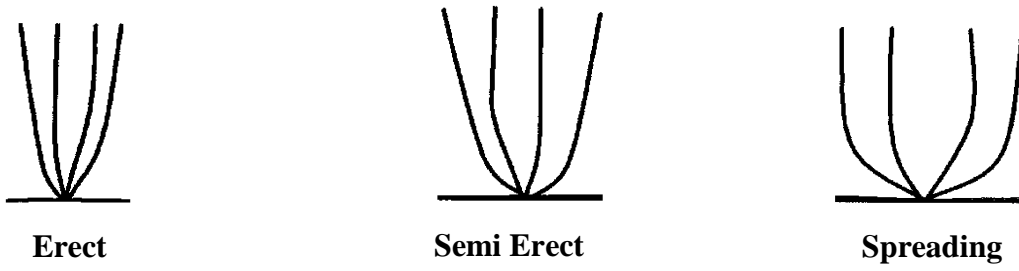


Figure 3: Stem Wings

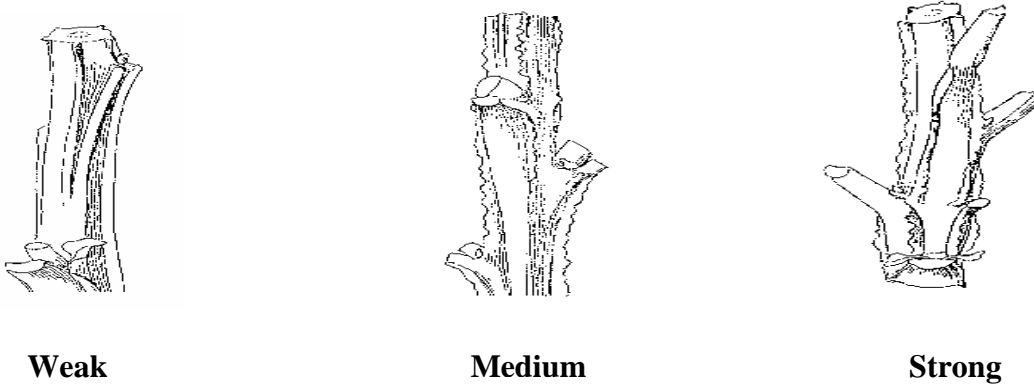


Figure 4: Leaf Silhouette

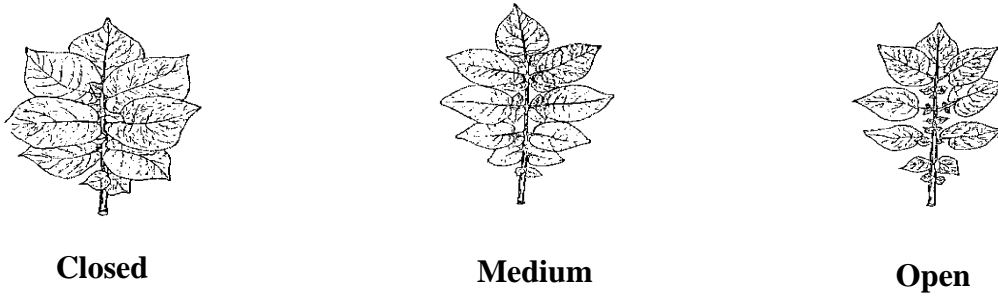


Figure 5: Leaf Stipules

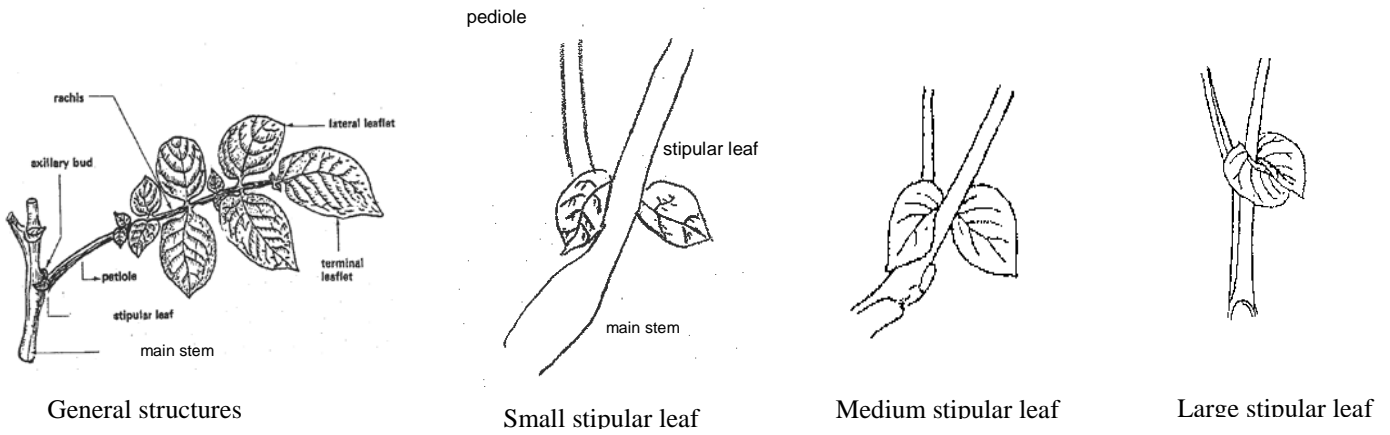


Figure 6: Leaf Dissection

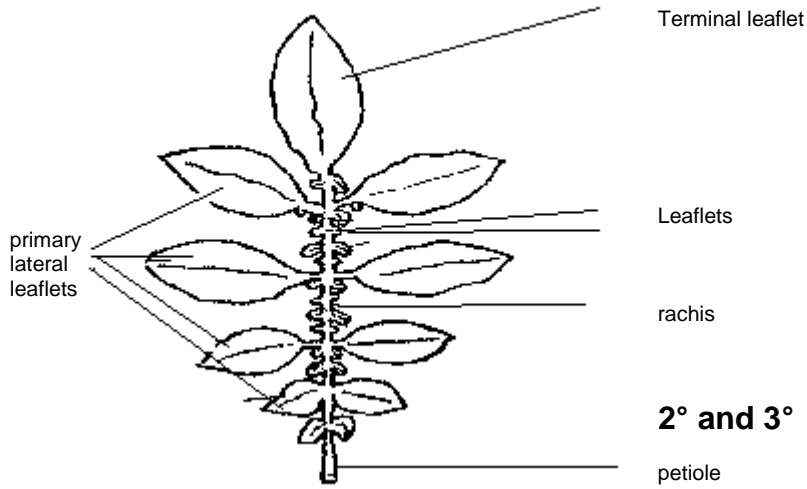


Figure 7: Terminal Leaflet Shape/Primary Leaflet Shape

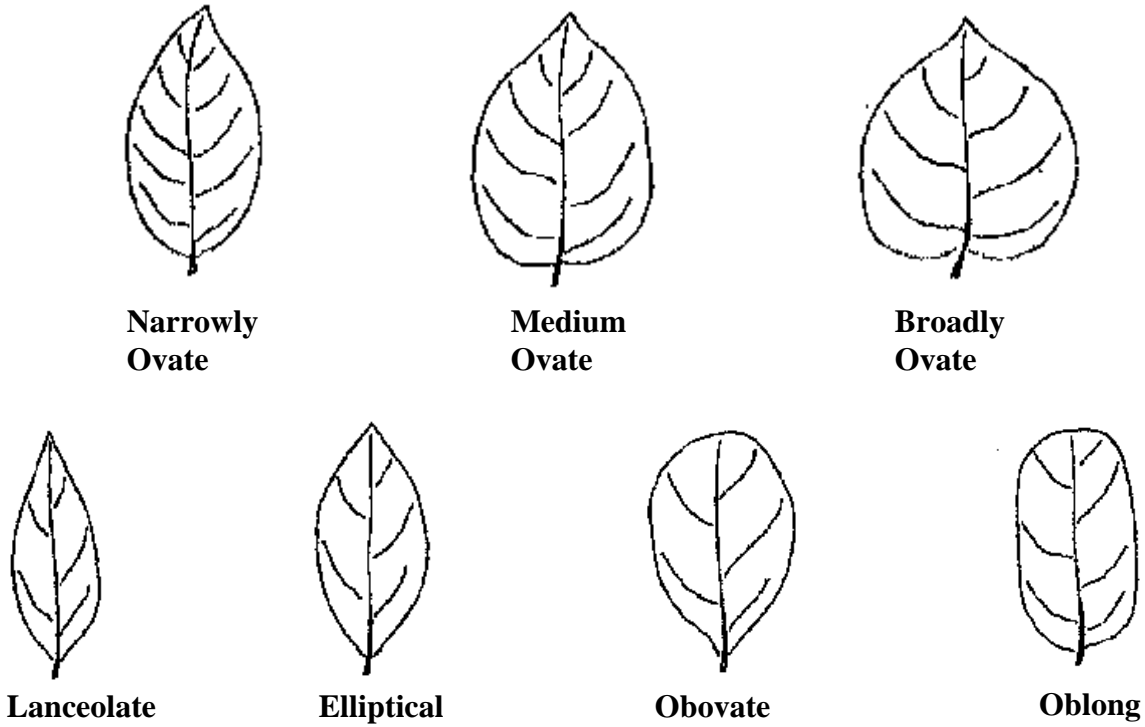


Figure 8: Terminal Leaflet Shape of Tip/Primary Leaflet Shape of Tip

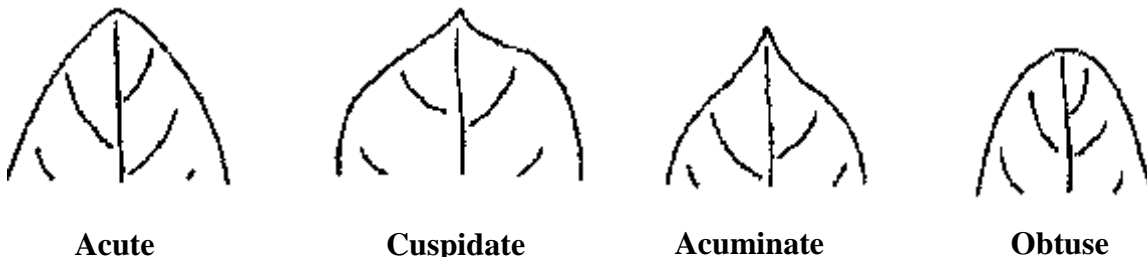


Figure 9: Terminal Leaflet Shape of Base/Primary Leaflet Shape of Base

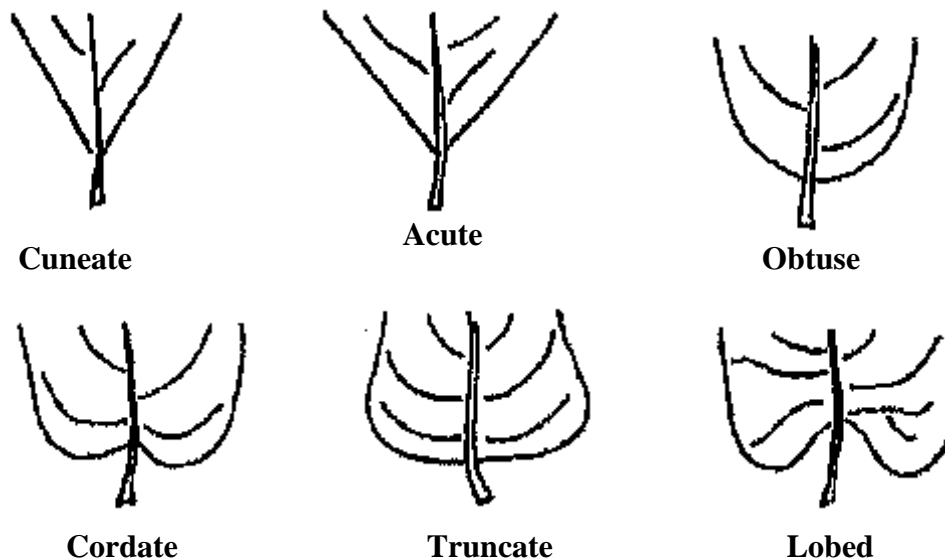


Figure 10: Corolla Shape

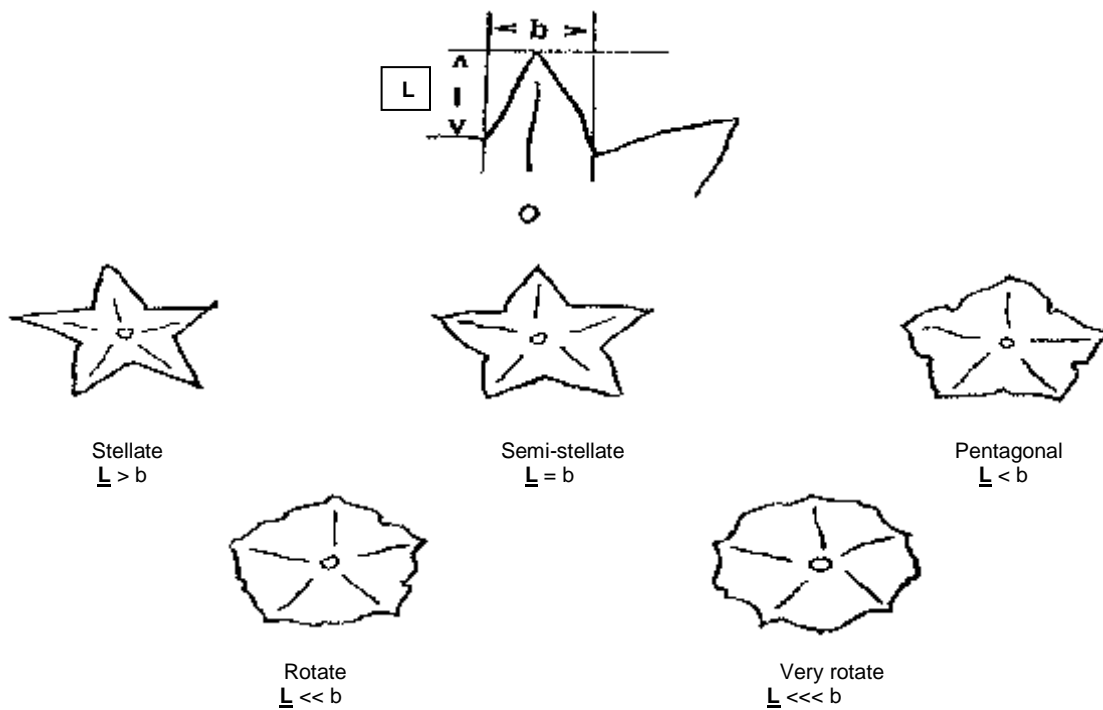


Figure 11: Anther Shape

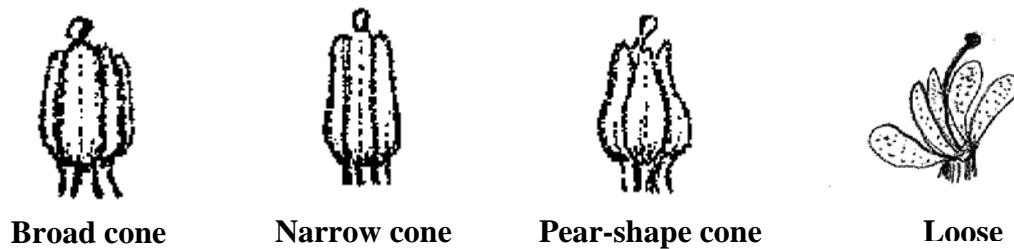


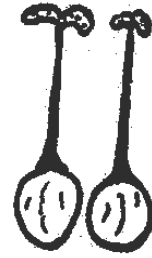
Figure 12: Stigma Shape



Capitate

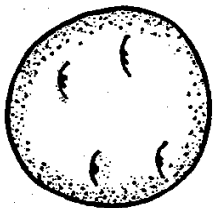


Clavate

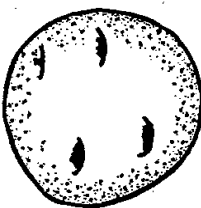


Bi-lobed

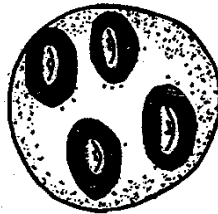
Figure 13: Distribution of Secondary Skin Tuber Color



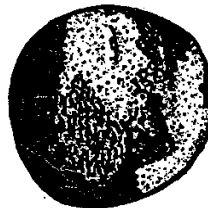
Eyes



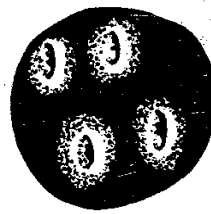
Eyebrows



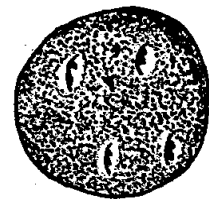
Splashed



Scattered



Spectacled



Stippled

Figure 14: Tuber Shape



Compressed



Round



Oval



Oblong



Long

References:

Huaman, Z. 1986. Systematic botany and morphology of the potato. Technical information Bulletin 6. International Potato Center, Lima, Peru.

Huaman, Z., Williams, J.T., Salhuana, W. and Vincent, L. Descriptors for the cultivated potato and the maintenance and distribution of germplasm collections. 1977. International Board for Plant Genetic Resources. Rome, Italy.

Potato (*Solanum tuberosum* L.) Guidelines for the conduct of tests for distinctness, uniformity and stability. International union for the protection of new varieties of plants (UPOV). 2004-03-31.