



Food and Agriculture Organization
of the United Nations

National catalogue of soybean varieties in Afghanistan



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Foreword

Soybean has become a very popular crop in Afghanistan because of its nutritional value and marketability. Recent research shows that soybean is well-adapted to growing conditions in most parts of the country, and can be used in multiple ways in Afghanistan to contribute to human and livestock nutrition. Soybean's nutritional importance stems from its high levels of protein, essential amino acids, healthy omega-3 fats and dietary fibre. Because it is less expensive than animal protein, soybean is known as the "Poor Person's Meat". The crop also has the ability to fix nitrogen in the soil and so is important for crop rotation and soil health. National soybean production has increased dramatically over the past 15 years, but considerable efforts are still needed to strengthen productivity, promote best cultivation practices, and to improve farmers' food and nutrition security and income.

This National Catalogue of Soybean Varieties is the first of its kind in Afghanistan. It is the result of collaboration between the Food and Agriculture Organization of the United Nations (FAO) and the Agricultural Research Institute of Afghanistan (ARIA) under the project "Strengthening Soya Production and Food Systems in Afghanistan" funded by the Embassy of the Republic of Korea. This catalogue is the outcome of two years of trials to identify and measure key characteristics of soybean varieties in Afghanistan, of both established and newly released varieties. Accurate descriptors are essential for registering varieties onto a National Variety List, for maintaining the characteristics of these varieties over time, and for controlling quality in seed production. This catalogue provides a template that will be continually updated as new varieties are released and older ones withdrawn from the national seed production system.

I take this opportunity to thank the Embassy of the Republic of Korea for its generous funding of this project, enabling FAO to support soybean production in the country. I would also like to thank FAO and ARIA colleagues for their collaborative work in producing this first National Catalogue of Soybean Varieties for Afghanistan. This catalogue will be an essential resource for all seed producers, seed certification staff and researchers engaged with soybean in the country, and makes an important contribution to the further development of this important crop.

Richard Trenchard

FAO Representative in Afghanistan

A handwritten signature in black ink, reading "Richard Trenchard", with a horizontal line underneath.

Acknowledgements

For the development of the National Catalogue of Soybean Varieties, it was essential to carry out field trials in multiple locations, and to analyse and report the data collected. The support of FAO management, the technical guidance of the national soybean expert, and the contributions of the Kabul and Balkh agricultural research stations were fundamental in the preparation of this catalogue.

Introduction

Currently most Afghan people struggle to provide sufficient and good quality food to their families – a total of 13.1 million Afghans are experiencing high levels of acute food insecurity, classified in Crisis of Emergency (IPC Phases 3+) according to the December 2023 IPC Analysis report. Soybean (*Glycine max* L.) is an excellent source of protein, oil and other key nutrients, with lower production costs compared to other sources of protein. Soybean contains an average of 40 percent protein and 20 percent oil on a dry weight basis. The remaining 40 percent consists of carbohydrates, vitamins, phytochemicals, minerals and other minor elements (Ghani *et al.* 2016). Importantly, soybean roots enrich the soil through symbiotic nitrogen fixation (Dhaliwal *et al.* 202 and DUS 4). Soybean has become an important part of the typical Afghan diet, especially in rural areas where people may have limited access to nutritious food. Currently Afghan people prepare different food recipes from soybean, for instance soymilk, soybean palaw and soybean naan or bread (blend of soybean flour with wheat flour). Therefore, it is very important to produce and distribute good quality seed of adapted and farmer-preferred soybean varieties, and help farmers learn about soybean's values for nutrition, soil fertility, and income.

The evaluation and introduction of new crop varieties are fundamental steps towards building a successful agricultural sector. Distinctness, Uniformity and Stability (DUS) tests play an important role in this. DUS tests are used to determine whether a new variety is different from existing varieties (Distinctness), whether the characteristics used to establish distinctness are expressed the same across all individual plants in the variety (Uniformity), and whether these characters remain unchanged over multiple generations (Stability). Conducting DUS trials to assess these characteristics and produce the National Catalogue of Soybean Varieties is therefore essential for releasing new varieties, registering these varieties on a National Variety List, maintaining variety traits over time, and for quality control schemes linked to the production of seed (field inspection, seed testing, control plot). DUS testing is a descriptive assessment to establish the identity of existing and new varieties using morphological, chemical characteristics, as well as the uniformity and stability of these traits. This phenotypic characterization helps build a database used to evaluate genetic diversity. Qualitative characteristics are more dependable for this characterization since these traits behave stably over environments and generations (Raut, 2003). Registration and testing of varietal characterization is an effective way to classify these varieties and prevent duplication (Das and Kumar, 2012). The catalogue presented here provides a baseline, characterizing the existing soybean varieties in Afghanistan, as well as a template for future work. DUS testing and registration of new varieties should be carried out on a regular basis, and the catalogue updated as new varieties are introduced to the system, while other entries may be withdrawn when that variety is no longer grown in Afghanistan.

This catalogue describes soybean varieties imported from the Republic of Korea and the United States of America which were released in Afghanistan after multi-locational assessment of their agronomic performance and adaptation to the country.



Plant variety

A plant variety represents a more precisely defined group of plants, selected from within a species and developed by breeders, that has a common set of characteristics. For the plant population to be recognized as a variety, it must satisfy at least three criteria: it must be Distinct, Uniform, and genetically Stable (DUS). Distinctness refers to significant differences between varieties in at least one important character recorded at one testing site for one season. Uniformity refers to the similarity in the genetic makeup of individual plants belonging to that particular plant population (variety). If a plant population maintains its characteristics in successive generations, it is considered stable. A lack of uniformity within a population indicates a lack of stability.

Importance of DUS testing

DUS testing is a way of determining whether a newly released or introduced variety differs from other varieties within the same species, whether the characteristics used to establish distinctness are expressed uniformly, and that these characteristics do not change over subsequent generations. Variety identification is essential for variety maintenance (purification), seed production (roguing), seed certification (field inspection), breeder's rights (protection), and above all commercialization (promotion).

A DUS test is usually conducted in the field or glasshouse over two successive growing seasons. During this period a number of mainly morphological characteristics are recorded.

National plant variety catalogue

The national variety catalogue is an official document in which all commercialized crop varieties in the country are registered and their major varietal characteristics listed. It is a valuable reference for public- and private-sector plant breeders, seed producers, and crop producers, as well as seed certification agencies, extension services, and plant variety protection offices.

Methodology

Field experiment plots were planted in two locations in Afghanistan with 12 soybean varieties, both established varieties and those new to the country. The methodology followed the international rules and regulations established as set by The International Union for the Protection of New Varieties of Plants (UPOV), procedures, and recommendations. The level of expression in different varieties was visually rated and recorded using a 1–9 scale. Data were recorded for two seasons at two sites – Balkh and Kabul – using two replications in each site. There were some differences in scores for the same character at both sites and seasons as well, in all probability due to human error or genotype by environment (GxE) interactions. In addition to field experiments, all 12 varieties were tested for grain quality characteristics such as percentage of protein, carbohydrates, ash, sugar, and oil content which are important for recognizing and distinguishing varieties, and for producers to understand values for different possible end-uses when they select a variety for cultivation. Peroxidase reactions of all 12 soybean varieties were tested to study the negative and positive reactions.



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Figure 1. Soybean field in Qargha research farm at Kabul.

Table 1. Characters and scoring methods

S. No	Characteristics	Abbreviations	Code	Wording
1	Hypocotyl: anthocyanin coloration	HAC	1, 2, 3	Green, green with orange brown, purple
2	Plant: growth type	PGT	1, 2, 3	Determinate, semi determinate, indeterminate
3	Plant: growth habit	PGH	3, 5, 7	Erect, semierect, horizontal
4	Plant: colour of hairs	PCH	1, 2, 3	Grey, light brown, dark brown
5	Plant: height	PH	3, 4, 5, 6, 7	Short (<40), medium (41-60), tall (> 60)
6	Leaf: shape of central leaflet	LSCL	1, 2, 3, 4	Lanceolate, triangular base, ovoid, elliptic
7	Leaf: shape of the lateral leaflet	LSLL	1, 2, 3, 4, 5	Rounded ovate, pointed ovate, trullate, lanceolate, elliptic
8	Plant days to flowering	PDF	3,5,7	Early, (<35 days) medium (36 to 45 days) late (>45 days)
9	Plant days of maturity	PDM	3,5,7	Early, (<95 days) medium (96 to 105 days) late (>105 days)
10	Leaf colour	LC	1,2,3	Green, dark green and purple
11	Flower colour	FC	1, 2	White, violet
12	Pod: colour	PC	1, 2, 3, 4	Black, yellowish brown, brown red, brown black, grey
13	Pod: pubescence	PP	1,9	Absent, present
14	Pod: intensity of colour	PIC	1, 5, 9	Light, medium, dark
15	Seed: size (100 seed weight)	SZ	3, 5, 7	Small (<10.0 g), medium(10.1-13g), large (>13gr)
16	Seed: shape	SS	1, 2, 3, 4	Spherical, spherical flattened, elongated, elongated flattened
17	Seed: ground colour of testa (excluding hilum)	SGCT	1,2,3,4,5,6,7	Yellow, yellow green, green, light brown, medium brown, dark brown, black
18	Seed: glossiness	SG	1, 2, 3	Opaque, intermediate, bright
19	Seed: peroxidase reaction	SPR	1, 2	Negative (absent), positive (present)
20	Seed: hilum colour	SHC	1,2,3,4,5,6	Grey, yellow, light brown, dark brown, imperfect black, black
21	Seed: colour of hilum funicle	SCHF	1, 2	Same as testa, different to testa
22	Seed: luster	SL	1,9	Shiny, dull

Characters and scoring methods: Table 1 was designed by the FAO technical team and arranged all the characters, codes and scoring of soybean accordingly as per the UPOV (International Union for the Protection of New Varieties of Plants) guidelines.



Figure 2. Hypocotyl anthocyanin Coloration



Figure 3. Flower Colour



Figure 4. Pod Colour



Figure 6. Seed Shape

Explanation of characters

Hypocotyl anthocyanin coloration

(HAC): the 12 varieties of soybean studied in the laboratory had colorations ranging from green, green with orange, brown, and purple.

Plant height (PH): The height (cm) of the plant was measured from the ground level to the tip of the plant at 75 percent physiological maturity stage. Height was varied by variety but was also affected by seasonal and environmental factors. Height was classified as: Short (<40 cm), Medium (41–60 cm) or Tall (>60 cm)

Flower colour (FC): Flower colour plays a significant role in distinguishing a variety among the evaluated varieties, 10 had violet and two had white flower colour.

Days to 50 percent flowering (DF):

Number of days from emergence to the time when 50 percent of the plants in the plots produced at least one open flower. The period of flowering varied significantly among the varieties assessed and was classed as: Early (<35 days), Medium (36 to 45 days), or Late (>45 days).

Days to maturity (DM): The number of days from emergence to the time when 75 percent of plants in the plot reached physiological maturity. This was classified as: Early (<95 days) Medium (96 to 105 days), or Late (>105 days).

Pod colour (PC): At physiological maturity the pod colour, which in the assessed varieties ranged from yellowish brown, to brown black, or grey.

Pod intensity of colour (PIC): in the assessed varieties, this was classed as Light, Medium, or Dark.

Seed size (SZ): The soybean Kernels size for the different varieties varies ranges



Figure 7. Seed hilum colour



Figure 8. Leaf Shape

from small to large size Small (<10.0 g), Medium (10.1–13 g), Large (>13 g).

Seed ground colour of testa (excluding hilum) (SGCT): the seed ground colour of testa excluding hilum varied among the assessed varieties from yellow green to green, light brown and medium brown.

Hundred kernel weight (HKW): Seed weight is an important yield component in soybean. In this study, 100-seed weight was measured after removing immature and damaged seed, and classified as: Small (<10.0 g), Medium (10.1–13 g), or Large (>13g).

Seed shape (SS): Seed shape also varies among soybean varieties, characterized as spherical, spherical flattened, elongated or elongated flattened.

Seed glossiness (SG): All the twelve soybean varieties were classed as either intermediate or bright.

Seed luster (SL): Mainly two types of soybean variety were observed, shiny and dull.

Seed colour of hilum funicle (SCHF): the seed colour of hilum funicle varies, and is either the same or different to the testa colour.

Leaf shape (LS): the leaf shape of soybean varieties is classified as: lanceolate, triangular base, ovoid, or elliptic.

Plant colour of hairs (PCH): this character did not appear to be stable across locations and seasons. Still some differentiations were observed, and classed as: Grey or Dark brown.

Hilum colour (HC): Hilum colour is a highly stable and polymorphic trait, but as soybean is a photosensitive crop, so light intensity, temperature, drought, disease injury, or other environmental factors may effect hilum colour and shape. Hilum colour was assessed as either: Yellow, Brown, Black, or Imperfect black.

Seed coat colour (Seed coat): Seed coat colour is an important phenotypic trait and has an important role in distinguishing varieties from each other, but this trait is not stable and can vary due to environmental factors. Seed coat colour was assessed as either: Yellow, Dark yellow, or Imperfect black.

Plant growth habit (PGH): Determinate growth type varieties do not produce further leaves on main stem once flowering has started. Indeterminate growth type varieties, on the other hand, continue to produce leaves on the main stem when flowering has started; in those varieties, vegetative and productive growth continues at the same time. This is why most of the short maturity group is determinate and the long maturity group includes mostly indeterminate soybean growth types.

Characterization of soybean varieties



1 | Getway 8711

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	309,929,5#6,259,002#6,288,308#
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

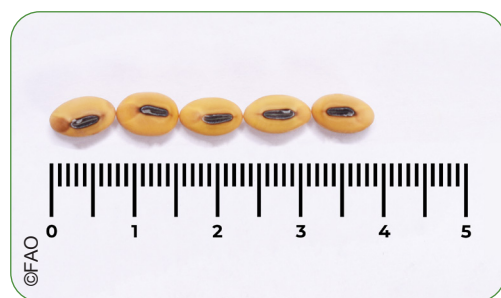
Ground colour of testa	Light brown
Hilum colour	Black
Colour of hilum funicle	Different to test
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Determinate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Triangular base
Leaf colour	Green



Seed Shape



Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Tall
Pod colour	Yellowish brown
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.3 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(26.3%)
2. Oil content (%)	(27%)
3. Carbohydrates (%)	(33%)
4. Energy (kcal)	(480 kcal/100 g)
5. Ash content (%)	(6.3%)
6. Moisture content (%)	(7.3%)
7. Isoflavone (mg)	(2813 mg/kg)
8. Sugar (%)	(3.64 %)



Coleoptile



Pod

2 | Stine 3400

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	15733-76x615741-13/15733-76
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Light brown
Hilum colour	Dark brown
Colour of hilum funicle	Different to testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Determinate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Grey
Flower colour	Violet
Leaf shape (Central leaf)	Triangular base
Leaf colour	Green



Seed Shape



Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Tall
Pod colour	Brown black
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.5 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(27%)
2. Oil content (%)	(25%)
3. Carbohydrates (%)	(34%)
4. Energy (kcal)	(472 kcal/100 g)
5. Ash content (%)	(6.02%)
6. Moisture content (%)	(7.40%)
7. Isoflavone (mg)	(1520 mg/kg)
8. Sugar (%)	(4.48%)



Coleoptile



Pod

3 | Hwangkeum

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	SS7006//Baekmokjangyeop
Seasonal type	Spring/Summer
Origin	Republic of Korea



Grain characteristics

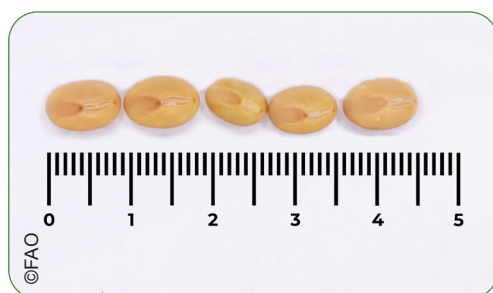
Ground colour of testa	Yellow
Hilum colour	Light brown
Colour of hilum funicle	Different to testa
Seed Luster	Shiny
Seed glossiness	Bright
Seed shape	Spherical
Seed size	Large

Plant characteristics

Growth habit	Erect
Growth type	Determinate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Triangular base
Leaf colour	Green



Seed Shape



Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Yellowish brown
Plant days to maturity	Late
Agronomic characteristics	
Yield potential	2.5 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(37%)
2. Oil content (%)	(22%)
3. Carbohydrates (%)	(28.6%)
4. Energy (kcal)	(460 kcal/100 g)
5. Ash content (%)	(5.04%)
6. Moisture content (%)	(7.35%)
7. Isoflavone (mg)	(1197.5 mg/kg)
8. Sugar (%)	(4.8163%)



Coleoptile



Pod

4 | Dewan

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	Suwon/133/milyang18
Seasonal type	Spring/Summer
Origin	Republic of Korea



Grain characteristics

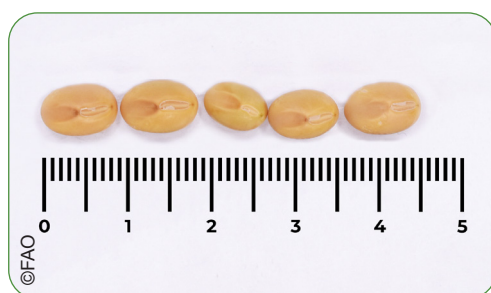
Ground colour of testa	Yellow
Hilum colour	Grey
Colour of hilum funicle	Same as testa
Seed Luster	Shiny
Seed glossiness	Bright
Seed shape	Spherical
Seed size	Large

Plant characteristics

Growth habit	Erect
Growth type	Determinate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

Days to flowering	Late
Plant colour of hairs	Grey
Flower colour	White
Leaf shape (Central leaf)	Ovoid
Leaf colour	Green



Seed Shape



Leaf shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Yellowish brown
Plant days to maturity	Late
Agronomic characteristics	
Yield potential	1.8 Mt/ha
Chemical reaction	
Seed peroxide reaction	Negative
Grain quality characteristics	
1. Protein content (%)	(27.5%)
2. Oil content (%)	(24.4%)
3. Carbohydrates (%)	(35.01%)
4. Energy (kcal)	(460 kcal/100 g)
5. Ash content (%)	(5.44%)
6. Moisture content (%)	(7.65%)
7. Isoflavone (mg)	(4246.7 mg/kg)
8. Sugar (%)	(6.5458%)



Coleoptile



Pod

5 | LD04-11056

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	U96-2208 x S38-T8
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

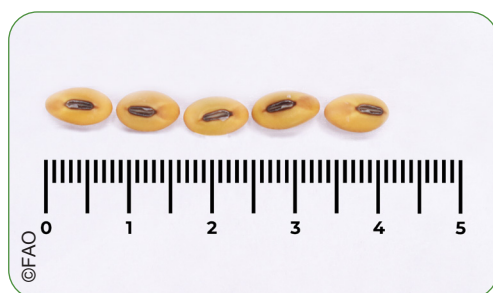
Ground colour of testa	Yellow green
Hilum colour	Black
Colour of hilum funicle	different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Determinate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Triangular base
Leaf colour	Green



Seed Shape

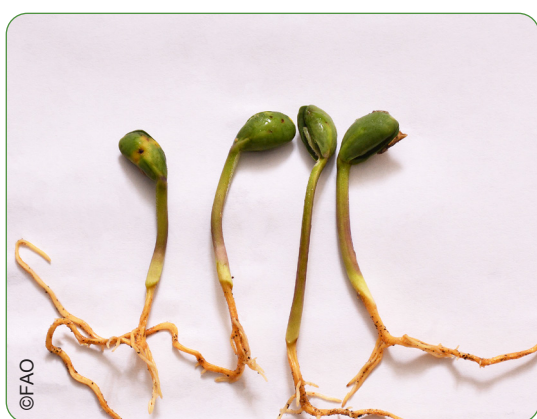


Leaf Shape

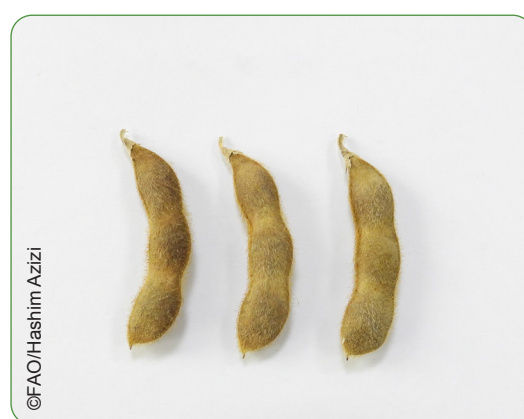


Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Brown black
Plant days to maturity	Late
Agronomic characteristics	
Yield potential	2.6 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(26.4%)
2. Oil content (%)	(26.6%)
3. Carbohydrates (%)	(33.75%)
4. Energy (kcal)	(480 kcal/100 g)
5. Ash content (%)	(6.28%)
6. Moisture content (%)	(6.97%)
7. Isoflavone (mg)	(2213.4 mg/kg)
8. Sugar (%)	(4.397%)



Coleoptile



Pod

6 | LD02-4485

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	M90-184111 x IA3010
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

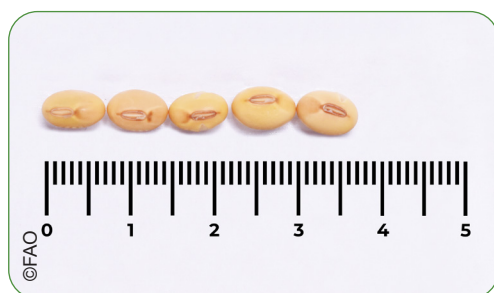
Ground colour of testa	Medium brown
Hilum colour	Yellow
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

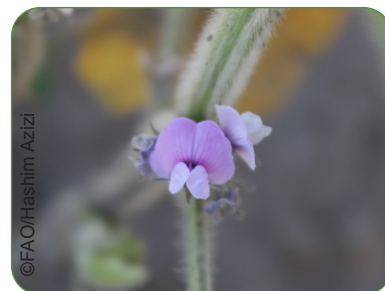
Days to flowering	Medium
Plant colour of hairs	Grey
Flower colour	Violet
Leaf shape (Central leaf)	Ovate
Leaf colour	Green



Seed Shape



Leaf Shape

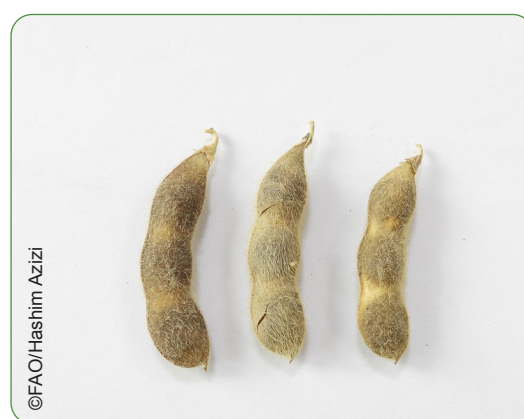


Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Brown
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.6 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(25.3%)
2. Oil content (%)	(26.6%)
3. Carbohydrates (%)	(34.71%)
4. Energy (kcal)	(479 kcal/100 g)
5. Ash content (%)	(6.40%)
6. Moisture content (%)	(6.99%)
7. Isoflavone (mg)	(1207.8 mg/kg)
8. Sugar (%)	(5.1231%)



Coleoptile



Pod

7 | LD04-13265

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	Syngenta S32-Z3 x U98-205355
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Medium brown
Hilum colour	Black
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Purple
Flower colour	Violet
Leaf shape (Central leaf)	Ovate
Leaf colour	Green



Seed Shape

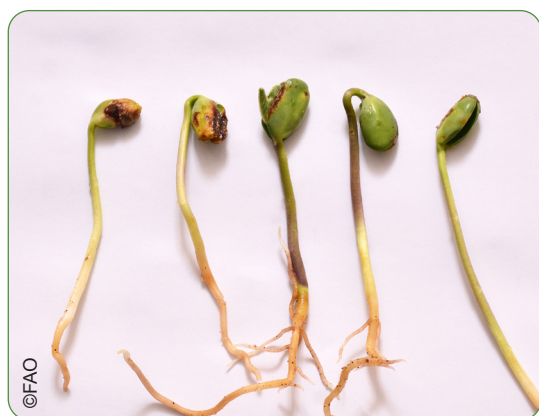


Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Yellowish brown
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.7 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(26.6%)
2. Oil content (%)	(26.7%)
3. Carbohydrates (%)	(34.65%)
4. Energy (kcal)	(585 kcal/100 g)
5. Ash content (%)	(6.30%)
6. Moisture content (%)	(5.75%)
7. Isoflavone (mg)	(2610 mg/kg)
8. Sugar (%)	(4.0594%)



Coleoptile



Pod

8 | LD05-1540

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	Syngenta S25-J5 x SS98-3403
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Medium brown
Hilum colour	Black
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Purple
Flower colour	White
Leaf shape (Central leaf)	Lanceolate
Leaf colour	Green



Seed Shape



Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Medium
Pod colour	Brown black
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.7 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(28.6%)
2. Oil content (%)	(26.0%)
3. Carbohydrates (%)	(32.32%)
4. Energy (kcal)	(478 kcal/100 g)
5. Ash content (%)	(6.02%)
6. Moisture content (%)	(7.06%)
7. Isoflavone (mg)	(1611.8 mg/kg)
8. Sugar (%)	(3.6404%)



Coleoptile



Pod

9 | LD09-30224

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	LD05-3230Xld05-6638xDwightxlnaxPI200538
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Light brown
Hilum colour	Light brown
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Large

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Lanceolate
Leaf colour	Green



Seed Shape

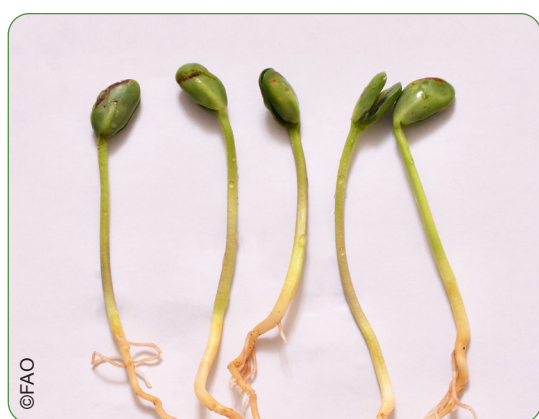


Leaf Shape

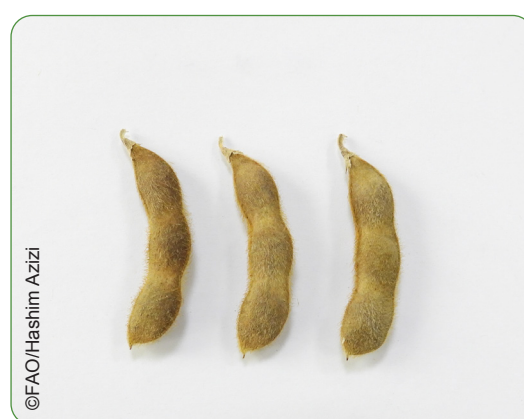


Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Short
Pod colour	Tawney
Plant days to maturity	Late
Agronomic characteristics	
Yield potential	2.5 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(33.1%)
2. Oil content (%)	(21.1%)
3. Carbohydrates (%)	(32.36%)
4. Energy (kcal)	(452 kcal/100 g)
5. Ash content (%)	(5.73%)
6. Moisture content (%)	(7.73%)
7. Isoflavone (mg)	(941.7 mg/kg)
8. Sugar (%)	(6.2696%)



Coleoptile



Pod

10 | LD10-9168

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	LD06-7648XLD02-4485
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Medium brown
Hilum colour	Black
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Ovate
Leaf colour	Green



Seed Shape

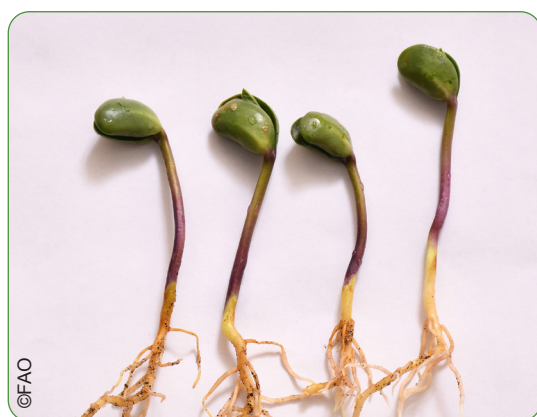


Leaf Shape

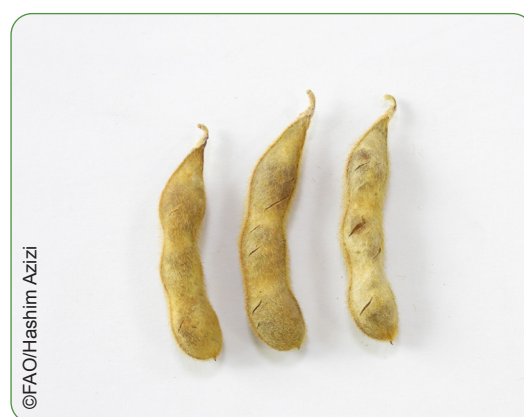


Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Tall
Pod colour	Yellowish brown
Plant days to maturity	Late
Agronomic characteristics	
Yield potential	2.8 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(26.1%)
2. Oil content (%)	(25.6%)
3. Carbohydrates (%)	(34.32%)
4. Energy (kcal)	(472 kcal/100 g)
5. Ash content (%)	(6.56%)
6. Moisture content (%)	(7.42%)
7. Isoflavone (mg)	(3798.1 mg/kg)
8. Sugar (%)	(4.3679%)



Coleoptile



Pod

11 | Stine 30E32

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	A3525x(5464705XA3525)
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground colour of testa	Medium brown
Hilum colour	Imperfect Black
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Green

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Dark brown
Flower colour	Violet
Leaf shape (Central leaf)	Ovate
Leaf colour	Green



Seed Shape



Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Tall
Pod colour	Black
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.9 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(31.1%)
2. Oil content (%)	(24.4%)
3. Carbohydrates (%)	(31.17%)
4. Energy (kcal)	(469 kcal/100 g)
5. Ash content (%)	(6.95%)
6. Moisture content (%)	(7.38%)
7. Isoflavone (mg)	(1613.71 mg/kg)
8. Sugar (%)	(3.94%)



Coleoptile



Pod

12 | Stine 29E22

Crop	Soybean
Common name	Soybean
Scientific name	<i>Glycine max</i> L
Pedigree	A3525x(5464705XA3525)
Seasonal type	Spring/Summer
Origin	United States of America



Grain characteristics

Ground Colour of testa	Light brown
Hilum colour	Imperfect Black
Colour of hilum funicle	Different as testa
Seed Luster	Dull
Seed glossiness	Intermediate
Seed shape	Spherical flattened
Seed size	Medium

Plant characteristics

Growth habit	Erect
Growth type	Indeterminate
Hypocotyl anthocyanin coloration	Purple

Flowering plant characteristic

Days to flowering	Medium
Plant colour of hairs	Grey
Flower colour	Purple
Leaf shape (Central leaf)	Triangular base
Leaf colour	Green



Seed Shape

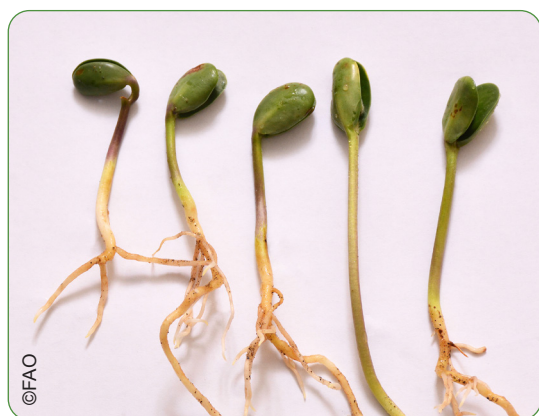


Leaf Shape



Flower

Mature plant characteristic	
Pod pubescence	Present
Plant height	Tall
Pod color	Brown
Plant days to maturity	Medium
Agronomic characteristics	
Yield potential	2.5 Mt/ha
Chemical reaction	
Seed peroxide reaction	Positive
Grain quality characteristics	
1. Protein content (%)	(30.7%)
2. Oil content (%)	(24.0%)
3. Carbohydrates (%)	(32.22%)
4. Energy (kcal)	(468 kcal/100 g)
5. Ash content (%)	(6.15%)
6. Moisture content (%)	(6.93%)
7. Isoflavone (mg)	(1688 mg/kg)
8. Sugar (%)	(4.4760%)



Coleoptile



Pod

ANNEXES



Table A1: Summary of qualitative and quantitative data scored in two consecutive seasons at Mazar and Kabul locations (Converted into 1–9 Scale)

Plot	HAC	PCT	PGH	PCH	PH	LSCL	LSL	Sz	PDF	FC	PC	PLC	SGCT	SG	SS	SPR	SHC	SCHF	SL	Plot	Variety
1	3	1	1	3	5	2	2	1	5	2	3	5	4	2	2	2	6	2	9	1	Getway 8711
2	3	1	1	1	7	2	2	1	5	2	4	9	4	2	2	2	3	2	9	2	Stine 3400
3	3	1	1	3	5	3	2	1	5	2	2	9	2	3	1	2	1	2	1	3	Hwangkeum
4	1	1	1	1	5	3	1	1	7	2	2	5	2	3	1	2	1	1	1	4	Dewan
5	3	1	1	3	5	2	2	2	5	2	4	9	2	2	3	2	6	1	9	5	LD04-11056
6	3	1	1	1	5	2	1	1	5	2	4	9	4	3	2	2	3	2	9	6	LD02-4485
7	3	1	1	1	5	2	1	2	5	2	2	1	2	2	2	2	6	2	9	7	LD04-13265
8	1	1	1	3	5	2	1	1	5	1	2	5	4	2	3	2	5	2	9	8	LD05-1540
9	3	1	1	3	3	3	2	1	5	2	2	9	2	3	1	2	2	1	9	9	LD09-30224
10	3	1	1	3	7	2	2	1	5	2	4	9	4	2	2	2	6	2	9	10	LD10-9168
11	3	1	1	1	7	2	1	1	5	2	4	9	2	2	2	2	4	2	9	11	Stine 30E32
12	3	1	1	1	7	2	1	1	5	2	4	9	4	3	2	2	5	2	9	12	Stine 29E22

Annexes: This table, designed and arranged by the FAO technical team and containing the summary of the data and all the required characters, presents the combined data from 2 locations over 2 years.

Table A2: Sampling procedure for the quality and physiological tests

I. SAMPLING PROCEDURE AT LOADING POINT

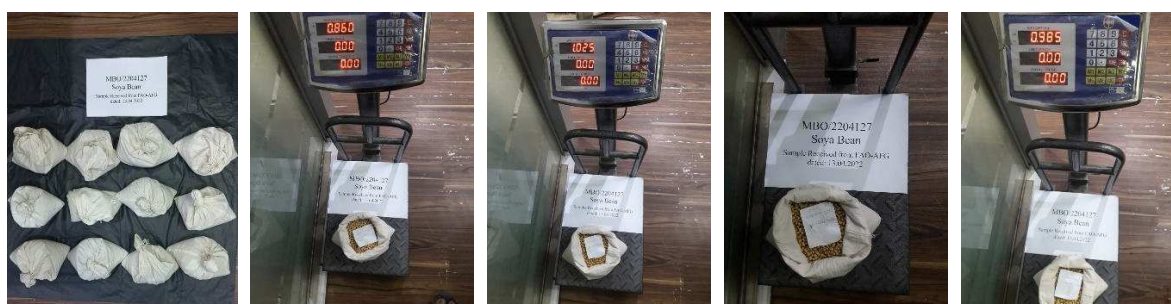
Sampling was performed in accordance with FAO requirements.

Variety of seed	Batch/lot number
Soybean, DUS 2021	V-LDo4-11056
	V-Stme30E32
	V-Stine 3400
	V-LDo10-9168
	V-Stme29E22, R-2, P12
	V-LDo4-13265
	V-LDo2-4485
	V-LDo9-10911, R-2, P9
	V-Gateway8711
	V-LD05-1540
	V-Deawon
	Hwangkeum

Samples were prepared by FAO Afghanistan and picked up by Baltic Control A/S inspector.

Samples were sent to the International Laboratory: CHELAB SRL, Via Fratta 25, 31023 Resana (TV), Italy.

Variety of seed	Batch/Lot number	Quantity of samples	Weight per each sample
Soybean, DUS 2021	V-LDo4-11056	1 sample	1.00 kg
	V-Stme30E32	1 sample	0.700 kg
	V-Stine 3400	1 sample	0.900 kg
	V-LDo10-9168	1 sample	0.800 kg
	V-Stme29E22, R-2, P12	1 sample	0.970 kg
	V-LDo4-13265	1 sample	0.980 kg
	V-LDo2-4485	1 sample	0.860 kg
	V-LDo9-10911, R-2, P9	1 sample	0.925 kg
	V-Gateway8711	1 sample	0.975 kg
	V-LD05-1540	1 sample	0.820 kg
	V-Deawon	1 sample	1.00 kg
	Hwangkeum	1 sample	1.00 kg



Arranged shows the sampling procedures for the quality and physiological tests.

Table A3: laboratory. Results have been obtained from International Laboratory: CHELAB SRL, Via Fratta 25, 31023 Resana (TV), Italy

Parameter	Method	Results	
		22/000312413 (V-Deawon)	22/000312414 (Hwangkeum)
Protein content	MP 1457 rev 3 2017	27,5±1,2 g/100g (N x 6,25)	37,0±1,5 g/100g (N x 6,25)
Oil content	RAPPORTI ISTISAN 1996/34 MET A PAG 41	24,4±1,3 g/100 g	22,0±1,2 g/100 g
Carbohydrate	MP 0297 REV 7 2021	35,01±1,82 g/100 g	28,61±1,97 g/100 g
Energy	MP 0297 REV 7 2021	470±7 kcal/100 g (1 965±27 kJ/100 g)	460±7 kcal/100 g (1 929±25 kJ/100 g)
Ash	MP 2271 REV 0 2018	5,44±0,30 g/100 g	5,04±0,30 g/100 g
Moisture content	MP 2480 REV 0 2021	7,65±0,30 g/100 g	7,35±0,30 g/100 g
Isoflavone Content (on provision of standards of Isoflavones	AOAC 2001.10 2016	4 246,7±329,5 mg/kg	1 197,5±94,4 mg/kg
Sugar (SUM)	MP 1114 REV 6 2016	6,5458±0,5808 g/100 g	4,8163±0,4502 g/100 g
• FRUCTOSE		0,204±0,015	0,0593±0,0077 g/100 g
• GLUCOSE		0,341±0,026	0,117±0,011 g/100 g
• LACTOSE		< LoQ g/100 g	< LoQ g/100 g
• MALTOSE		0,0308±0,0080 g/100 g	< LoQ g/100 g
• SUCROSE		5,97±0,58	4,64±0,45 g/100 g
Seed Peroxidase Reaction (SPR) Test	REGCE 2706/71	Negative	Positive

Arranged the laboratory result by the international laboratory of CHELAB SRL, Via Fratta 25, 31023 Resana (TV), Italy.



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